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TECHNICAL FILE

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FLIGHT

The AIRCRAFT ENGINEER

OFFICIAL ORGAN OF THE ROYAL AERO CLUB SEPTEMBER 24th, 1942

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BRITAIN'S STRENGTH IN THE SKIES.

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"One of the most impudently daring flights of the war" . . was when a "Bristol" Beaufighter flew over the Arc de Triomphe in Paris at house-top level, to drop a tricolour over the Unknown Warrior's Tomb.

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FLIGHT
and
The AIRCRAFT ENGINEER

FIRST AERONAUTICAL WEEKLY IN THE WORLD : FOUNDED 1909

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The Outlook

Across the Seven Seas

THE United Nations are fighting in nearly all parts of the world, and from every quarter comes the call for more aircraft of one class or another. The allocation of the output of British factories must be one of the most delicate problems which the higher authorities have to settle.

So far as fighters go, obviously the defence of Great Britain is the governing consideration, and when that demand has been reasonably satisfied the only question is the sharing out of the surplus (if such a word is ever justified) between various calls from overseas, though even in the case of fighters some fronts are more important than others. Bombers set a more complex problem. The very word "bombers" is now a generic term, including a number of sub-classes in the single-, twin-, and four-engine categories. In the demand for bombers there is a distinct rivalry between Great Britain and all the other fronts, and some commentators call for a definite priority to be granted to one of these fronts and the subordination of all the rest.

These commentators may be divided into those who can think only of aircraft and those who believe in combined operations. The former are inclined to advise that the strategic bombing of German production is so all-important that every other air effort must take second place. The latter turn their thoughts towards either the Middle East, or a second front in Europe, or to safeguarding Australia and reconquering the Pacific, or to supplying Russia and China.

As a matter of fact, not one of these fronts can be disregarded, but for the moment the weight of authoritative opinion favours concentration of effort in the Middle East. Field Marshal Smuts is one of the most eminent authorities, though by no means the only one, who holds that the defence of Egypt and the Canal, and still more the assertion of supremacy over the Mediterranean and its African shores, are the primary business with which British and Allied strategy should now concern itself.

This plan of campaign calls for air mastery over both land and sea. On the Libyan front we have now and have held for some time past, a useful degree of air superiority. Yet it is generally admitted that land victory in Libya depends on superiority in armour, not in aircraft. The latter need to keep their superiority, but it is armour which must win the battle. When the time comes that all Italian Africa is safe in Allied hands, then the next step must be an attack on the Italian fleet in which large numbers of heavy bombers will find plenty of work to do. Naval aircraft will naturally work with the Royal Navy at sea, but the Italian fleet must be left with no harbour of refuge, and that work calls for heavy bombers in large numbers. There would be need for Combined Operations in which each Service would help the other two. To make the Mediterranean a *Mare Britannicum* would offer the most dazzling prospects for further aggression.

None the less, bombing of German production must go on. The American Fortresses are beginning to show the possibilities of daylight bombing, which, if the bomb load is adequate, must be more deadly than any work by night. At the same time, their 0.5 guns have shown a capacity to defend themselves against the attacks of fighters. These tactics may also lead us far. And, despite what may be done in the Middle East and against German production, there must be no slackening of the Allied effort to prepare for the day when our armies, with powerful air components, will meet the *Reichwehr* on the Continent of Europe.

The Eagle Squadrons

THE three Eagle squadrons of the Royal Air Force are following the example of the Escadrille Lafayette in the last great war. That squadron was formed as a unit of the French Army (there was then no separate *Armée de l'Air*), the pilots being Americans who were living in France. The "Ace" of the squadron was Lufbery, who finally jumped out of his burning fighter—there were no parachutes in those days except for balloon observers. When the United States entered the war, the Escadrille Lafayette was transferred from the French to the American Army.

Now the Eagle squadrons have been transferred from the Royal Air Force to the United States Army Air Force. The people of Britain, we feel assured, are full of gratitude to the members of those squadrons who came to fight for Britain and the cause of freedom while their own country was in the position of a benevolent neutral. They could not be classed (in Biblical phrase) as unprofitable servants who had only done their duty. They have done more. Now they naturally join up with their own forces, and all other American citizens who have joined the R.A.F. or the Royal Canadian Air Force are free to do likewise if they so desire. They all carry with them a warm feeling of gratitude from the British, with whom and for whom they have fought, and *Flight* wishes them all good luck in their new career.

A Patriotic Duty

WHEN David was King of Israel there was a dispute in his army between the troops who did the fighting and those who guarded the baggage in any battle, the fighting men claiming that the booty taken was rightfully theirs. In consequence, nobody wanted to be detailed for baggage guard. The King settled it by deciding that all should share alike.

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An analogous position has recently arisen in the R.A.F., not about booty, for aircraft bring none home with them, but about honour and glory, the desire to face the fire of the enemy and to have a chance of winning a decoration for gallantry. Every pilot wants to get into a fight and in consequence a difficulty has arisen in finding enough flying instructors. This tendency, natural and creditable as it is, might have very unfortunate consequences if it went too far. The Air Force must have flying instructors, and very good ones, too, if it is to maintain its ascendency in the air. Of course, every pilot is not suited by temperament to be an instructor, but those who are ought to regard it as a duty to their country and their Service to undertake that work. In fact, men who believe themselves suitable ought to volunteer for training as instructors.

Mainly, we think, pilots who have already been in action against the enemy ought to be asked to volunteer, but every man ought to do the work by which he can best help the country.

DAY AND NIGHT FIGHTERS: A formation of four-cannon and eight-gun Hurricanes of the United Provinces of India Squadron. The squadron's score to date is 134½ enemy aircraft destroyed, 46 probables and 42 damaged.

Russian D.B.3F. medium bombers flying in formation. The D.B.3F. is a medium/heavy bomber, with a span of 70ft. 2in., a length of 46ft. 10in., and a maximum speed of over 270 m.p.h. The engines are M-88 radials of 1,100 h.p. each.

War in the Air

Combined Raid on Tobruk : U.S. Bombing in the Pacific : Bomber Command Keeps it Up

TOBRUK has succeeded Dieppe as the scene of a Combined Operation. On the night of Sunday, September 13th, a military force was conveyed to Tobruk by the Navy and landed there, while R.A.F. bombers went to work overhead. It is believed that the landing party spent its time destroying harbour installations, while the bombers, who were out in force, concentrated on military targets a bit inland where they ran no risk of hitting men of their own side. Unfortunately two Tribal class destroyers, H.M.S. *Sikh* and *Zulu* were lost by gunfire from shore batteries. Though Tobruk harbour has been sedulously bombed ever since the enemy captured it, the bombs dropped by night have not demolished some important parts of the harbour works, for every bomb cannot score a direct hit on a small target, and so men from the Army were put ashore to make a complete job of the demolitions. More details will doubtless be made public.

The day after this raid American heavy bombers attacked Suda Bay, in Crete, by daylight. At least one enemy ship was hit and set on fire. The aircraft all returned safely.

Though it is now some time since

SOLOMONS DISPERSAL : A U.S. Navy Grumman F.4F. Wildcat fighter taxying to its dispersal point. It is similar in most respects to the Grumman Martlet.

WAR IN THE AIR

the great United States victory of Midway Island, it has only just been announced that the carrier *Yorktown*, of 20,000 tons, was lost in the battle. The loss of the carrier *Lexington* was admitted at the time, as it was certain that the Japanese knew that fact, but they might not have known the fate of the *Yorktown*. She was damaged by air attack and hit by both bombs and torpedoes, but it was hoped that she might be saved. A Japanese submarine put an end to this hope by hitting her with two torpedoes. The U.S. Navy is still possessed of five aircraft carriers.

In the Pacific

THE Japanese have been making an attempt to regain their ascendancy in the Solomon Islands, but their efforts appear to have been half-hearted. The Americans have not got complete control of the seas to the north of the islands, and enemy cruisers approach the islands, sometimes landing small bodies of troops, sometimes shelling the American positions. It is, however, significant that these vessels always come by night. The American answer is by air action, and recently two Japanese cruisers were reported hit, one by a bomb and the other by an air torpedo. The aircraft which attacked them were naval torpedo-bombers, Devastators and Avengers. A naval fighter has also been in the news, namely, the Wildcat, which is the U.S. version of the Grumman Martlet. Martlets are used as carrier fighters in the Royal Navy, so there is probably no great difference between the two types.

A ZERO AT ZERO: A Japanese OO fighter shot down on one of the Aleutian Islands by the gunners of a U.S. naval patrol. It is from such wrecks as these that intelligence officers prepare the general arrangement drawings as shown on page 341.

The Americans have also made a heavy attack on one of the Aleutian islands occupied by the Japanese, Kiska by name. This raid was entrusted to the Army Air Force, and was carried out by Liberators escorted by Airacobras and Lightnings. Several ships were sunk or damaged, and among the latter were three submarines. The defences were not strong, and six enemy aircraft were destroyed, four of them being Zero fighters which were shot down in the air. No American machines were lost.

In Papua fierce fighting has been in progress on the Owen Stanley range, and the Australian troops have been holding their own. Again the air action by the American Army has been vigorous, and the chief Japanese base at Buna on the northern shore is constantly bombed. Fortresses have also raided Rabaul, where Zero fighters which tried to interfere were driven off with some loss, and again the American machines all returned safely.

Maj. Gen. G. C. Kenney, of the American Army Air Force, who has just been appointed commander of all the Allied Air Forces in the South-west Pacific, has made a very encouraging statement. He compared the Kittyhawk fighter with the Zero, and said: "Our planes are better armoured than the Zeros, and have bullet-proof tanks which enable us to get to close quarters with the Japanese and slug him. . . . When a Zero catches a good burst from our fighters it just crumples up. I have seen them burst into flames and fall to pieces in the air. On the other hand, I have seen one of our planes return to base with 200 to 300 bullets in the fuselage. . . . The Zero is admittedly easier to manœuvre than our fighters, but the Japanese are welcome to that. Our pilots like to get close in."

These conclusions tally with the fighting theories of the Poles in the R.A.F. They, too, like to close the range. Long-range firing on land, on sea, and in the air is always likely to

TOUGH-LOOKING GUYS: This picture, retouched by order of the U.S.A. War Department, shows fully-equipped U.S. infantrymen and other "freight" in a Curtiss Commando military transporter. The machine has a span of 108ft. and weighs 50,000 lb. fully loaded.

WAR IN THE AIR

ENEMY AIR LOSSES TO SEPT. 19th.

	Over G.B.	Over Continent	Middle East
Sept. 13	0	0	0
,, 14	1	0	1
,, 15	1	0	6
,, 16	0	3	2
,, 17	1	3	2
,, 18	0	1	(No date) 2
,, 19	2	0	0
	5	7	13

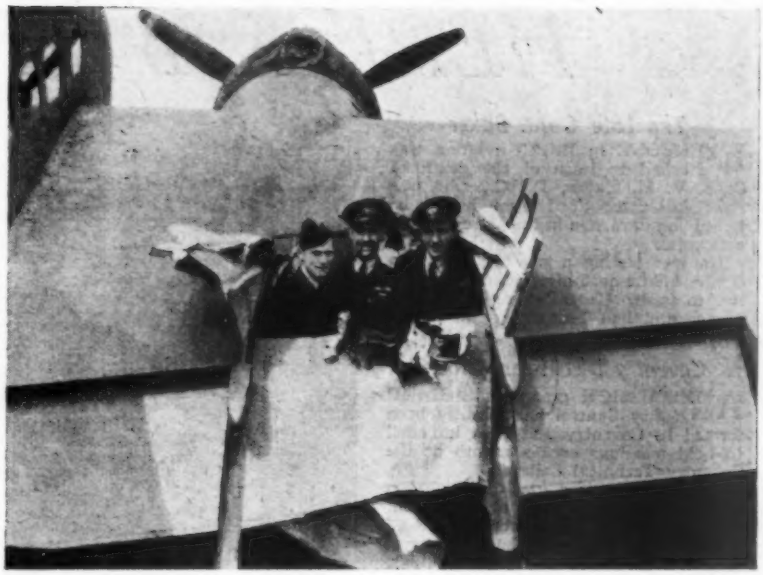
Totals : West, 6,343 ; Middle East, over 4,558.

be less accurate than firing at close range, and when both gun-platform and target are moving at very high speed, and both manœuvring in three dimensions, the difference between long and short range firing is certain to be especially marked.

The Western Front

IT has now been announced that Bomber Command has been dropping 8,000 lb. bombs on the western front. Perhaps it was one of these monsters which caused a terrific explosion in a recent raid on Wilhelmshaven. This explosion astonished even experienced bomber pilots who were over the port at the time, and they attributed it to a very large oil store exploding. At any rate, a Stirling pilot said that it was too big to be just a 4,000 lb. bomb exploding. This particular raid was carried out with a loss of only two of our bombers. Other raids have been made on Essen and the Ruhr, on the Saar coalfield and on Munich, and in all these places very large fires were started. All raids now are concentrated into very short periods of time, giving no opportunity to the defence services to deal with one fire at a time.

Daylight raiding by fighters and light or medium bombers have been continued, and Mustangs of Army Co-operation Command have taken part in some of them. Many locomotive engines have been put out of action. The *Luftwaffe* has retaliated mainly with tip-and-run raids by Fw.190 fighters, which mostly work in pairs. It is very difficult to intercept such raiders.



IN A DREADFUL FLAP : The pilot of a Hudson and two of his crew standing in the hole made by an A.A. shell when attacking a German convoy off the Dutch coast.

BRITISH AIR LOSSES TO SEPT. 19th.

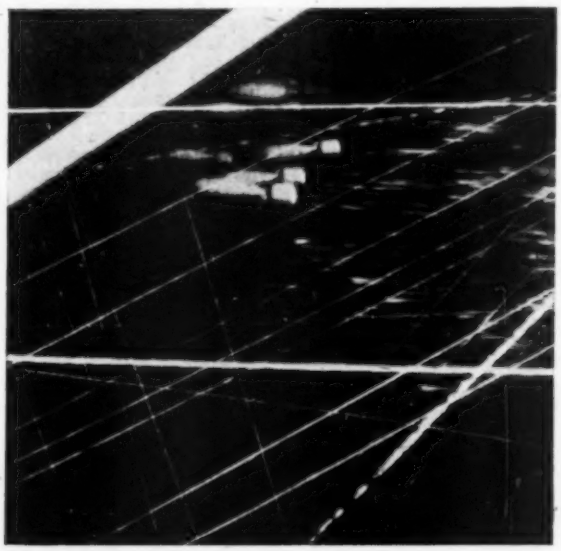
	Over G.B. A'crft.	Over Continent B'brs.	Over Continent F'trs.	Middle East A'crft.
Sept. 13	0	19	0	4
,, 14	0	2	0	0
,, 15	0	0	0	7
,, 16	0	39	1	2
,, 17	1	1	1	1
,, 18	0	5	0	2
,, 19	0	10	0	0
	—	—	—	22*
	1	76	2	—
	—	—	—	38

Totals : West, 4,766 ; Middle East, about 1,710.
* *Not reported before.*

Heroic Russian Defence

THE Germans have forced their way into some of the outskirts of Stalingrad, and as we go to press desperate fighting is going on in streets and suburbs. In this sort of fighting aircraft can take hardly any part, but in the stages before the enemy got into the suburbs the Germans were using their bombers as their normal every-day artillery, and were holding their tanks back, or using them with a good deal of caution. They outnumbered the Russians in aircraft, but the Red Air Fleet was still in the picture and was fighting back with great spirit. At night numbers do not count in the same way, and one German correspondent at Stalingrad said that he could not sleep at night because the Russian aircraft came over so often and flew very low. He also said that the Russians seemed to know the places where the Germans were short of ammunition and had to be economic in the use of A.A. shells.

The German fighter squadrons in Russia are said to have been re-equipped with a new type of Messerschmitt, the Me.109G. This machine is said to have a liquid-cooled engine of 1,700 h.p., and according to one account can reach a height of 40,000 feet. The speed is given as about 325 m.p.h. at 13,000 feet. The armament is stated to be three cannon and two machine guns. It probably has a pressure cabin for the pilot. Last spring a new Me. fighter of the designation 209 was referred to in the Press as under development. It was credited with a ceiling of 42,000ft. and a maximum speed of 398 m.p.h. at 21,000ft. A Daimler-Benz 603 type liquid-cooled engine was the power unit named, and a German source gave the wing span as 31ft. 2in.



FLAKLIGHT PHOTOGRAPH : A salvo of bombs going down during a night attack on enemy shipping. The photograph was taken solely by the light of the flak.

HERE AND THERE

The Late Capt. Baker

EVERYONE in British aviation was shocked to learn of the death of Capt. V. H. Baker, D.F.C., who was chief instructor at Heston before he joined James Martin in the Martin-Baker enterprise.

He was testing a new fighter when engine failure just after take-off caused him to crash. Capt. Baker was 54 years of age and had been flying for nearly 30 years.

Coventry Discussion Group

A DISCUSSION group on Statistical Quality Control has recently been formed in Coventry and it is intended to hold meetings once a month at the Coventry Technical College.

The meetings, the first of which has just been held, are to be at 10.30 a.m. on Sundays, and those interested should get into touch with the hon. secretary, Mr. S. H. Franklin, 45, The Chesils, Coventry.

A Few of the First

ALTHOUGH the general public will be given quite a different (and erroneous) impression by a recently released and much publicised film, the fact remains that the majority of the R.A.F. fighters in the Battle of Britain were Hurricanes.

To mark the anniversary of that great defeat of the *Luftwaffe* by the Homeric few of Fighter Command, Sir Frank Spriggs, chairman of the Hawker directors, sent the following message to the workers on Hurricane aircraft:—

"Two years ago you provided the backbone of the Force which beat the *Luftwaffe*. Carry on the good work."

A.T.A. Pilots

A QUESTION asked recently in the House by Major Marlowe, drew from the Minister of Aircraft Production, Col. Llewellin, the information that of 1,500 A.T.A. applicants selected for interview, flight test, and medical examination, approximately 400 had been rejected.

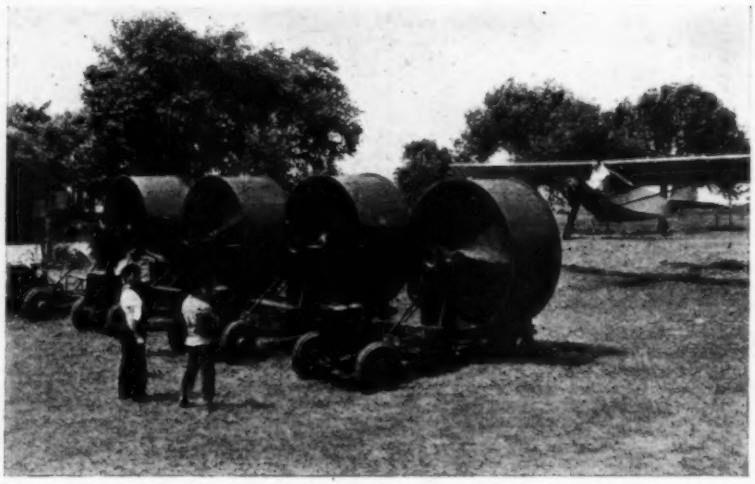
"Without a considerable amount of work," added Col. Llewellin, "it is impossible to say how many who passed their flight test were rejected on other grounds."

A high standard of physical as well as of mental fitness is necessary, and applications from suitable candidates are invited.

"M" Scheme Graduates

TRAINED under the Ministry of Labour and National Service's "M" Scheme for educating factory workers to become foremen and works supervisors, 51 men were recently presented with certificates at Acton Technical College by Mr. R. C. Rootes, who paid tribute to the value of these training courses.

Mr. G. E. Still, production superintendent of the Associated Equipment Co., Ltd., who is in charge of the training courses, said that this was the tenth group of students to complete the training, and he believed they had set up a record for the whole country by putting in 97 per cent. attendances.



ZERO GROUND SPEED: The battery of four Winchester "Wind Waggons" provides enough air-speed to lift the glider at the end of its anchor cables. The pupil pilot thus learns in complete safety.

Praise, Indeed

EALING'S two A.T.C. squadrons have legitimate cause to feel proud of themselves; they have also been given a standard to live up to, which is even more important.

When they were inspected recently by Grp. Capt. Carthew, Commandant of the Eastern Command, A.T.C., he told them that Air Chief Marshal Sir Robert Brooke-Popham had written to him and told him he would find the Ealing A.T.C. among the smartest in his large area.

Grp. Capt. Carthew, a veteran R.F.C. pilot of the last war, laid special emphasis on the vital work of ground staffs, and said that the two men he best remembered from the old days were his engine fitter and his rigger. "They saved my life over and over again," he said.

He also paid a tribute to the civilian instructors, who, he said, gave of their time and experience without thought of reward and "without even the glamour of a uniform."

Fifty Years with Sternol

THE many friends of Mr. H. Bell Thompson will be interested to hear that 1942 marks his fiftieth year with Sternol, Ltd.

He joined the parent company (Sterns, Ltd.) as a junior in 1892, and eventually became general manager and a director of the firm. On the formation of Sternol, Ltd., in 1928, he was appointed its managing director, but retained his directorship on the board of the present firm.

A presentation by the company to Mr. Bell Thompson marks his "Golden Jubilee."

Gauge and Toolmakers Association

A TRADE association has been formed to promote the interests of the gauge and toolmaking industry; membership is confined to manufacturers and does not include agents and distributors. The association is intended for makers of tools for specific jobs, and does not cover stock articles such as drills, taps and reamers.

At present there are four sections of membership, i.e., gauges and measuring equipment, jig, fixtures and special tools, press tools, and, finally, moulds and dies. Subscriptions are graded according to the turnover of the firm.

Enquiries regarding the association should be made to the secretary, A. Walters, 5, Great Winchester Street, London, E.C.2.

Silver Jubilee

DURING the last war technical collaboration between Mr. L. W. Wild and the late Mr. E. P. Barfield was largely the basis on which the firm of Wild-Barfield Electric Furnaces, Ltd., was founded, the partners being busy on the subject of heat treatment in connection with the then national war effort.

The firm, greatly expanded since those early days, has just passed its 25th birthday, but it is far too busy getting maximum output of heat-treatment equipment for the present war effort to hold any birthday celebrations.

They Had No "Flight" Chart

THE Alaskan road-builder was telling his pals about the huge mosquitoes that came with the Spring thaw out there.

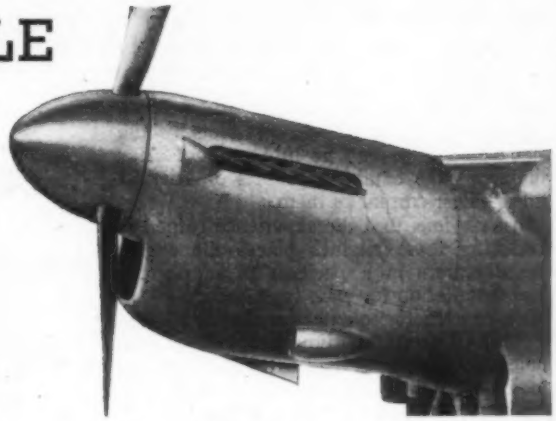
"Were they very big ones?" somebody asked.

"Say, feller," replied the man on leave, "one of them pests landed on an airfield and the ground staff put 80 gallons of gas into the durned thing before they got wise!"

Now if only they'd had a *Flight* Identification Chart of American Aircraft——!

INTERCHANGEABLE POWER PLANTS

Advantages of Standardisation : The Increasingly Important Role of Engine Manufacturers



A completely cowled Merlin XX power plant on an inboard nacelle of the Lancaster.

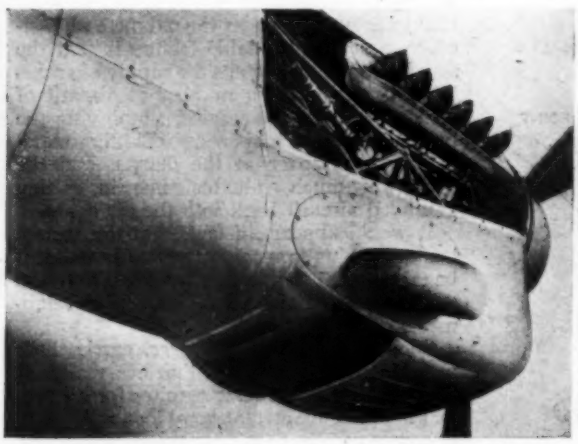
NORMALLY there may be many reasons for the choice of a liquid-cooled power unit in preference to an air-cooled unit. The reverse may equally well apply; for example, such reasons may be due to the equipment available at the factory from which the aircraft originates or possibly the available equipment of an air force or operating company for which the aircraft is intended. On the other hand, the reasons may be purely technical, such as maintenance problems, or from an economic point of view.

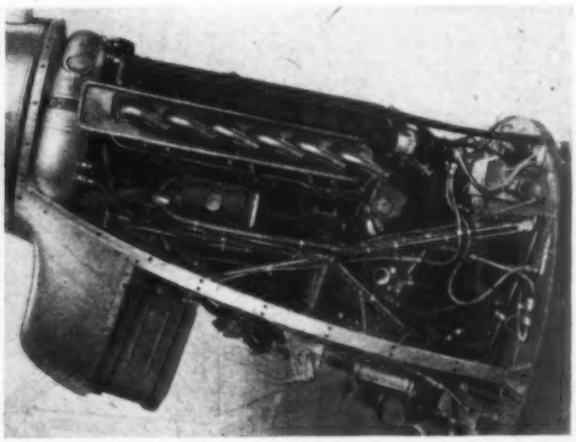
No longer, however, do we dwell in normal times. In war every possible feature must be introduced not only to produce aircraft engines at an hitherto undreamed of rate of production, but also to ensure that no aircraft in the R.A.F. or British aircraft in the service of our Allies can be "grounded" because of a power plant that requires overhaul or repairs. A system that does much to remedy this condition is the standardised power plant whereby not only the engine but the installation complete with cowling and mounting, etc., are supplied, less the bulkhead, as a unit by the engine manufacturer. The bulkhead is likewise standardised to the extent that not only the fixing points for the mounting are common for liquid-cooled or air-cooled installations, but connections for pipes, electrical couplings, pneumatic and hydraulic controls are also arranged for ready interchangeability.

One of the most enterprising and important developments in the aircraft industry was when, a year or so before the war, the changed attitude of the authorities permitted the aircraft engine manufacturers to get together and through their installation design departments develop the complete power unit upon a standardised basis which also permitted rapid interchangeability of type. Thus the Air Ministry and also the S.B.A.C. realised the great advantages of this scheme of standardisation, should we find ourselves at war, not only as a great aid to production but also to maintenance in the field of operations. It has since been proved conclusively that this policy has been of the greatest value and, as a result, much valuable time normally required by the aircraft manufacturer to design and produce just another engine mounting and cowling (very similar to the last but not quite) can now be saved entirely by accepting for the prototype aircraft a standardised unit complete, developed and produced by specialists of the engine manufacturers themselves. Thus the engine manufacturers' contribution to any aircraft is a larger one than is generally appreciated.

A Problem for Specialists

The development of a power unit from the experimental stage to the production model is a long and tedious business, involving the solution of a large number of intricate problems step by step, and research and experiment are demanded on almost each individual component. Furthermore, the protracted testing in flight of the complete unit is necessary under the critical observation of skilled technical observers and engineers before the complete unit can be said to be satisfactory for operation in the Services. The aircraft-engine manufacturers must necessarily, therefore, have at their dis-





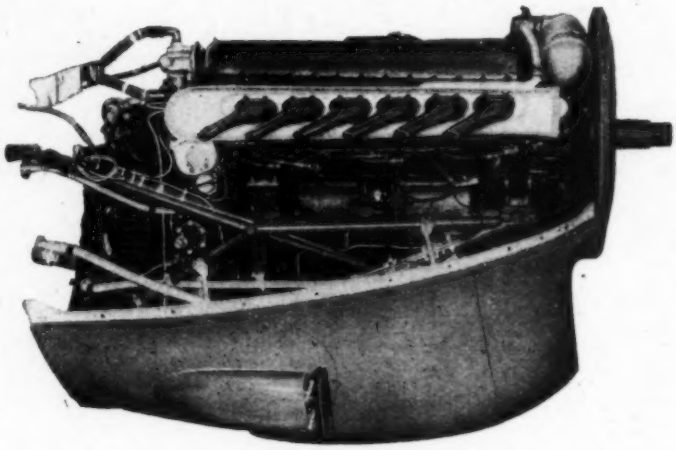
(Left) A threequarter rear view of a Merlin XX port inboard power unit. (Right) An outboard power plant of the Lancaster with side and top cowlings removed.

INTERCHANGEABLE POWER PLANTS

posal a large staff of research workers and engineers to develop their products to the stage when they may go into production as reliable as the combined efforts of scientist and engineer can make them.

It is obvious that the experience gained in producing these engines places the engine manufacturers in a position to supply the ideal installation for each type. For the airframe constructor to cater for the installation of various engines, liquid-cooled or air-cooled, means that skilled extra staff must be carried, if, indeed, they can in these days be obtained. In any case, they cannot obtain the solution to the problems of adequate cooling arrangements, reduction of drag and similar problems, to the same extent as the engine manufacturers themselves who are constantly confronted with these difficulties and overcome them in the course of their daily routine.

Thus it is in the interests of all concerned —and especially so at the present time, when the rate of production is of vital importance— that the aircraft manufacturer can leave the installation safely in the hands of power-unit specialists.

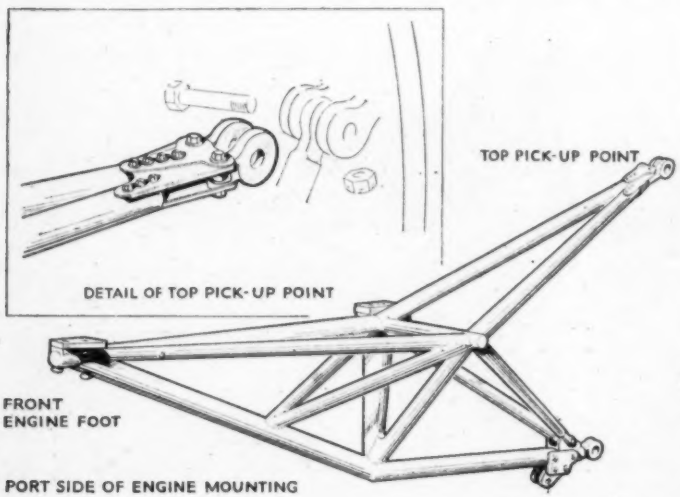


A complete interchangeable unit ready for despatch to the aircraft constructor to bolt on at the pick-up points. The bulkhead is not supplied with the power plant.

A Time-saving Development

As an example of the time-saving value of this system as distinct from the old procedure of the bare engine only being supplied, a single-seater fighter (prototype) was recently undergoing its initial flight trials approximately nine weeks from the starting of the design. Similarly the conversion of a twin-engined bomber to a four-engined type took less than 12 weeks from the start of the modified design to the first test flight.

In each case the same standardised power unit installation was supplied by the engine manufacturer. Organised co-operation of this kind between the airframe and engine manufacturers is speeding production, and indicating to the whole world that the British aircraft industry is equal to anything that may be imposed upon it now or in the future. From the engine manufacturer's point of view there are advantages in taking over the responsibility for the supply of the complete standardised unit. Engine design right from the planning stage is now considered in relation to the layout of the complete power plant as applied to the airframe, whereas previously, engines were often well advanced in the development stage before this was even considered, frequently with unfortunate results to the aircraft constructor.



Detail of the engine mounting to the airframe.

Servicing Simplified

Now that we are concerned with the quantity production of aircraft upon an unprecedented scale, the use of the standardised power unit is obviously a great advantage to this end. When it comes to considering the repair, maintenance and servicing of the engine in the field, the standardised unit again has much to commend it.

It has been proved that changing the standardised plant requires approximately 40 per cent. of the time normally required to change the engine under the old method. Another most commendable feature is that the standardised unit permits the supply of spares to be available for a number of aircraft of various types in the service, simplifying the production of such spares, facilitating storekeeping and space at the depots, and the saving of much valuable time in getting grounded aircraft back into the air again.

It would appear, in fact, that the system has everything to recommend its use unless it be argued that standardisation tends to retard the progress of aircraft design and development.

Such an argument, however, carries little weight when it is realised that every aircraft designer and constructor requires for his project a power plant that combines reliability, adequate cooling, minimum drag, and an arrangement that permits rapid and easy maintenance and servicing in the field. Surely

there is no one better able to study and combine all these requirements than the full-time experts and installation designers of the engine manufacturer. Such technicians have at their command not only experience gained from their own test flights, but the additional experience gained from the behaviour of the power plant and previous power plants in service on various types of aircraft operating under all sorts of conditions and climates in the various theatres of the war. It should be added that all the engine cowlings are interchangeable as they are made on jigs and checked on reference jigs.

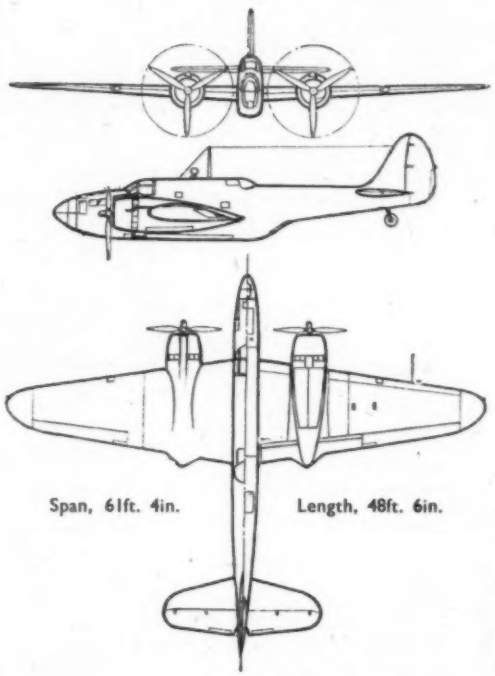
One of our latest aircraft that makes use of the interchangeable standardised power unit is the Avro-Lancaster bomber, and photographs of the Rolls-Royce Merlin installations accompany these notes.

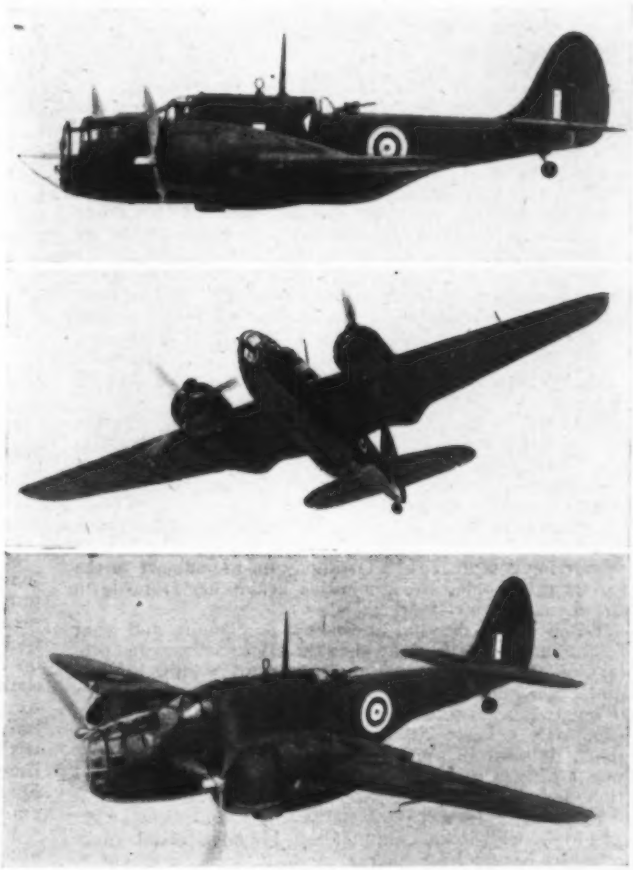
In a recent article which appeared in this journal on the estimation of take-off weight for a heavy bomber, the author states that for two identical aircraft of the same gross weight the bomb load varies as much as 50 per cent., the fuel and oil load being the same in both cases. The author goes on to say that to balance the difference the engine weight must be considered.

It appears, then, that here is another advantage of the standardised power unit, for if by a rapid change of the engine installation the bomb load can be considerably increased for the same range, then for certain operational duties this is certainly a great asset.

A CAPITAL SHIP

Martin Baltimore Doing Good Work in Middle East





SINCE the prototype made its first test flight on June 14th of last year, the Martin 187, known to the Royal Air Force as the Baltimore, has gone into large-scale production, and recently the type has figured in the news from the Middle East, where it has been doing very good work.

The Baltimore is classed as a medium bomber, but with the increase in bomber size we may soon come to look upon it, and others of similar size, as a light bomber. In any case, the Baltimore was designed for speed rather than for heavy bomb loads, as its small size and clean exterior indicate.

Its family resemblance to the Martin Maryland is obvious, although differences in the arrangement of armament have changed the silhouette outline of the fuselage, the "expansion" having taken place both in an upward and in a downward direction. The careful fairing of the upper gun turret is in marked contrast to that of the Maryland, in which there was a rotatable dorsal turret.

The very pointed nose of the fuselage should provide a much better entry for the air than did the rounded nose of the Maryland, and the fitting of two Wright 14-cyl., double-row Cyclone engines in place of the two P. & W. Twin Wasps has given a very substantial increase in the power available. All these factors together have resulted in a great increase in speed (315 m.p.h. compared with 275 m.p.h.).

At a speed of 2,400 r.p.m. the take-off power of the Wright GR2600-A5B engine is 1,600 h.p. At sea level the power is 1,350 h.p. at 2,300 r.p.m., and with the blower in low gear the power is the same at the same speed and 5,000ft. With the blower in high gear the Cyclone 14 develops 1,275 h.p. at 2,300 r.p.m. at 11,500ft.

Other engine figures of interest are: compression ratio, 6.30:1; blower ratios, 7.14:1 and 10:1.

CAN KAISER DO IT?

T. P. Wright says the Shipbuilder's Scheme is Impossible : Conversion of Bombers Suggested Instead : Kaiser Not Interested in the C-46

HENRY J. KAISER, described by David Shawe in the August 15th issue of *American Aviation* as "the West Coast shipbuilder, dam builder, and construction miracle man," made such an impression on Washington when he put in a week's intensive work there that the immediate result was the authorisation for him to prepare plans and data on the manufacture of 500 Martin Mars flying boats, and also "to begin engineering on his proposed 200-ton super flying boat," with a view to its production as soon as the Mars was well under way.

Kaiser claimed, it will be remembered, that by the conversion of nine shipyards from the building of surface vessels to the production of cargo aircraft, he could be turning out ten Mars flying boats from each shipyard within three months of starting and increase this output to 40 per month per yard within a year, a production rate of 5,000 flying boats a year.

Chance to Prove It

In an article headed "American Air Transport" in *Flight* of September 10th, we pointed out that Kaiser's achievement in just about decimating the normal time taken to build surface ships had been something which everyone thought impossible and that with this engineering "miracle" to his credit, his proposals to churn out big air freighters at a hitherto unheard-of rate would be certain to receive a respectful hearing at Washington.

He not only got a respectful hearing, but he is being given the chance to show what he can do. "The time that is being wasted talking about whether he can do the job," said Donald Nelson, chairman of the War Production Board, "might better be spent in letting Kaiser demonstrate whether or not he is able to do what he says he can do."

But there is at least one man in America who openly says that Kaiser's suggestions are not possible. That man is T. P. Wright, of the famous Curtiss-Wright Corporation and Deputy Director of the War Production Board's Aircraft Production Division.

The curious thing is that at the very time Kaiser was "selling" his scheme to the Truman Committee, Wright was giving comprehensive testimony on the subject to the special cargo plane sub committee in another room down the corridor.

Wright was polite but he was not ambiguous, and what he said amounted to this: that the suggested possible production figures (advanced by Kaiser) were entirely false and misleading, that it would take at least eighteen months if not two years to get even the first aircraft of any such production scheme into the air, that it was not in the public interest to accept and widely publicise the statements of men who had no experience of aircraft production, but would be much wiser to rely on those who had.

Mr. Wright did not think that either the facilities or the materials which the shipbuilding industry could make available would lend themselves to any useful extent to aircraft construction. "The major portion of any programme of cargo planes which could be built within a reasonable time," he said, "would be constructed of aluminium alloy. This is in many respects less critical than alloy steel, but there is not a great deal of aluminium alloy used in shipbuilding." He also said that the number of suitable machine tools which shipbuilding could provide would be "relatively small."

Other arguments advanced against the Kaiser proposals were that even the automobile industry had found it impossible to contribute substantially to machine tool equipment useful in building aircraft, and the motor industry was much nearer to the aircraft industry in type of operation than was shipbuilding. There was also the problem of producing engines, airscrews, instruments and other equipment already critical in the aircraft programme, not to mention the fact that shipbuilders would need a lot of training to learn the new business and their managements would also have to "acquire a certain know-how" before they would be very effective.

In short, Mr. Wright set forth an array of snags and apparently insurmountable obstacles which would surely have discouraged a less energetically determined person than America's No. 1 "Miracle-man." But he did not, of course, attempt to discount the urgent need for air freighters of *some* kind, and being a constructive critic he put forward as the solution the conversion of existing types of bomber aircraft. The almost inevitable effect of this suggestion, if it were adopted, would be to keep the business of building aircraft within the aircraft industry to the exclusion of Mr. Kaiser, but we should be the last to suggest that any such consideration had influenced the expressed opinions of T. P. Wright.

Now let us see what Mr. Kaiser himself has had to say by way of answer to all these objections to his scheme, and also to at least one alternative suggestion put to him.

Dealing with the second point first, it is reported that Robert Patterson, Under-Secretary of War, said he realised the necessity for more cargo planes but questioned the advisability of cutting into the military aircraft programme at present. He therefore suggested that Kaiser should build the Curtiss-Wright C-46 Commando under Army sponsorship, as being the best available cargo type.

One might have expected that Mr. Kaiser, in his eagerness to turn his versatile manufacturing abilities to anything that would help the Allied cause, would at once have said, "Okay, if that's the ship you want, of course I'll build it," or words to the same helpful effect.

But according to *American Aviation*, Mr. Kaiser is reported to have expressed indifference to this idea, "feeling that the C-46 could better be built in established plants while he concentrated on something newer and bigger."

Glenn Martin Ready to Help

Mr. Kaiser, of course, has from the first evinced an exclusive interest in the Martin Mars as the subject for his proposals, and has spent some time at the Glenn Martin plant in Baltimore inspecting the Mars. Moreover, Mr. Glenn Martin himself has signified his readiness to co-operate, and when asked if he thought the Mars could and should be built in shipyards, he replied, "We are anxious to make every possible contribution to the rapid development of an air cargo transport fleet. If the Government wishes us to follow the suggestions of Mr. Kaiser and license the shipbuilding companies to help manufacture the Mars type of air vessel, we shall be glad to do so and to extend our full co-operation."

Regarding the objections raised by Mr. Wright, Kaiser admitted he knew very little about aircraft construction, but pointed out he had never been in a shipyard before his company started breaking records on Liberty vessel construction. As for materials, he cited numerous examples of these which "weren't available" for his shipbuilding programme, but which he managed to find or produce, and much the same applied to machine tools.

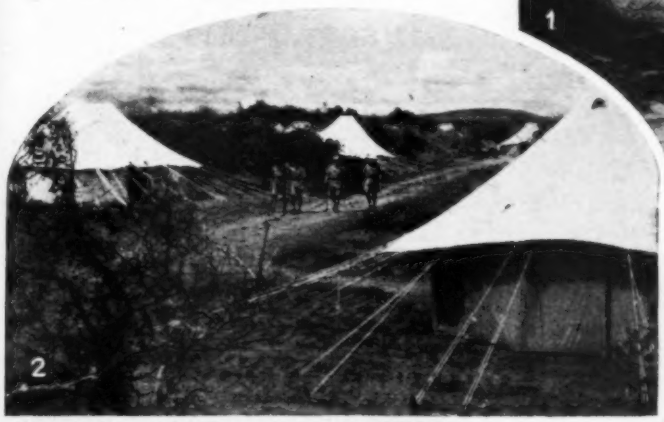
"There is no shortage of materials or machines if there is the will of achievement," he said. "Shortages exist only in the ground or in people's minds."

He repeated that he could engineer the Mars for production in 60 days, and as for skilled labour, he'd had to train his shipbuilders and 7,000 were still under training, but they were turning out ships faster than they'd ever been turned out before.

FLEET AIRMEN TAKE A REST

EVEN our hard-worked flying sailors need a brief rest occasionally, and these pictures provide a glimpse of life at a Fleet Air Arm rest camp in East Africa.

It may not be very luxurious, but a spell of leisure on solid earth provides a refreshing "break" from life on an aircraft carrier and they are at least guaranteed fine weather for their well-earned holiday.



1. Naval ratings unloading camp beds ; hotels are a bit scarce in these parts.

2. A party of F.A.A. officers arrive on foot.

3. Nobody minds if you read your paper at table ; it's three days old, but it's still news to these stalwarts.

4. A long stick with a forked end for dealing with snakes is more necessary here than a gas-mask.

5. The camp kitchen may be a trifle primitive, but it never fails to deliver the goods—Dinner is served, gentlemen !

6. This bearded "Samson" is blissfully secure in his tent from any troublesome Delilah, though he may at first miss the sea's soothing (?) motion.

IN PARLIAMENT

No "Leakage" Before Dieppe : Enquiry Into Sunderland Tragedy : Suspension of Daily Express Advocated : Abolition of Aerial Warfare After Axis Overthrow

Dieppe Raid

Mr. Purbrick asked the Prime Minister whether he has any statement to make in respect of the enemy having anticipatory information of the recent raid on Dieppe; and what steps he is taking to prevent such leakage of information in future?

The Deputy Prime Minister (Mr. Attlee): My right hon. Friend the Prime Minister is quite satisfied that there was no leakage to the enemy of prior information about the Dieppe raid. The second part of the Question does not arise.

Anti-aircraft Measures

Sir L. Lyle asked the Secretary of State for Air whether, in view of the increased number of daylight attacks on this country by low-flying German aircraft, he will arrange for a greater proportion of Lewis and Bren guns with high-angle mountings to be provided on the top of suitable buildings on the South Coast and other vulnerable areas.

Sir A. Sinclair : All available weapons are disposed to the best tactical advantage with the object of defeating the attacks.

Sunderland Accident

Sir R. Glyn asked the Secretary of State for Air whether the Air Ministry have ordered a court of enquiry into the accident to the Sunderland aircraft conveying His late Royal Highness the Duke of Kent, on passage to Iceland; and whether, in view of all the circumstances, the composition of the crew, the weather conditions and time of day, he will undertake to publish the findings and thus allay public anxiety on the grounds that proper care was not exercised.

Sir A. Sinclair : A court of enquiry is investigating the causes of the accident. I propose to make a further statement when its report has been received and considered.

Qualified Dispensers

Miss Ward asked the Secretary of State for Air whether he is aware that the lack of sufficient qualified pharmacists serving as such with the Royal Air Force, whether they be members of the Royal Air Force or the Women's Auxiliary Air Force, is causing disquiet; that this has been increased by the recent case in which a member of the Women's Auxiliary Force died as a result of being poisoned by being given caustic soda instead of liquid paraffin; and what steps he is taking to remedy this scarcity.

Sir A. Sinclair : There is no shortage of qualified dispensers in the R.A.F. to fill established posts and I am not aware of any disquiet of the kind suggested by my hon. Friend. The lamentable event referred to in the question was not due to any lack of trained men or women.

Miss Ward : Has my right hon. Friend had any representations from professional advisers?

Sir A. Sinclair : No, Sir.

Miss Ward : Would he consider any representations that might be made by those who are qualified?

Sir A. Sinclair : Yes, Sir.

Loss of H.M.S. "Eagle"

Sir Waldron Smithers asked the Minister of Information the name of the newspaper which did not comply with the Government's request and announced the sinking of H.M.S. *Eagle*; and what action he proposes to take?

Mr. Lewis asked the Minister of Information the name of the newspaper which ignored the request of the Admiralty to withhold publication of the loss of H.M.S. *Eagle*, pending the receipt of information as to survivors; and if he will consider suspending the publication of this paper for one day to mark the widespread public resentment at its proprietors' disregard for the feelings of relatives of the ship's company?

Mr. Bracken : The name of the newspaper concerned was the *Daily Express*. I have no power to suspend the publication of a newspaper.

Sir W. Smithers : Can the Minister stop this "getting away from Government requirements" in future by suppressing this paper for a month? That would stop all these leakages.

Mr. Bracken : The Ministry of Information is concerned with expression, not suppression.

Mr. Shinwell : Could my right hon. Friend have a word with his friend Lord Beaverbrook?

Mr. Gallacher : Will the Minister advise the *Daily Express* and other national papers to study the columns of the *Daily Worker*?

Aircraft Production

Mr. J. Dugdale asked the Minister of Aircraft Production how many plants producing aero-engines have been compelled to effect changes in their managements on account of an inadequate standard of efficiency; how many plants have been put under Government controllers for the same reason; and whether he is satisfied that no further steps can be taken to bring up the level of the least efficient plants to that of the most efficient?

Colonel Llewellin : The answer to the first two parts of the Question is "None, Sir." As regards the last part, it is my constant endeavour to increase the efficiency of factories engaged on aircraft production, and I have in several instances recently persuaded firms to strengthen their managements.

Aerial Warfare Propaganda

Mr. Sorensen asked the Minister of Information whether he has utilised the number of civilian casualties caused by air raids in this country, in Spain, in the Axis invasion of European countries and in Germany and Italy, and other facts respecting the full effect of devastation, the indiscriminate nature of aerial warfare, the responsibility for its continuance and the cumulative menace to European civilisation, to impress on German, Italian and other peoples of Europe the imperative necessity of abolishing or restricting aerial warfare through an international authority; and whether he will emphasise to the German and Italian peoples that the overthrow of their Governments will also secure the abolition of aerial warfare?

Mr. Bracken : We have done everything in our power to make known to the peoples ruled by the Axis Governments the full extent of the suffering those Governments have brought upon the world; and our efforts have been powerfully reinforced by the operations of the Bomber Command of the Royal Air Force.

Mr. Sorensen : Does the right hon. Gentleman not agree that if we continue the good work of impressing upon the people of Europe that at the end of the war aerial warfare will be abolished it will make a great appeal to common folk both in the Axis countries and elsewhere?

Mr. Bracken : The Air Chief Marshal and I are working on joint account in bringing these lessons home.

Current Affairs

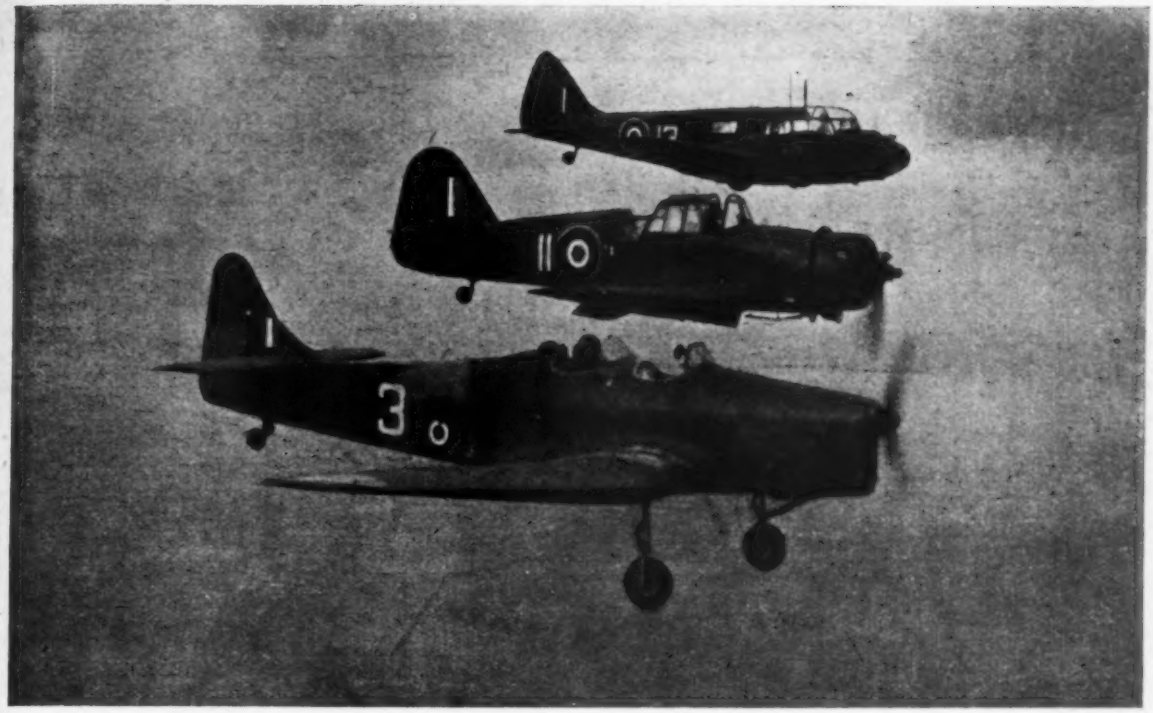
Mr. J. Dugdale asked the Secretary of State for Air whether he will set up an organisation for the Royal Air Force of a similar kind to the Army Bureau of Current Affairs.

Sir A. Sinclair : A scheme of regular weekly lectures on current affairs was introduced into the Royal Air Force in October, 1941. In addition, the pamphlets prepared by the Army Bureau of Current Affairs are distributed to all Royal Air Force stations, where in many cases they form the basis of discussion by regular discussion groups. It is proposed in the coming winter to extend the existing arrangements by organising regular discussion groups at all Royal Air Force stations. Since the Army Bureau of Current Affairs is able to cater in this way for the needs of the Royal Air Force, it is unnecessary to establish a separate organisation.

Defective Runways

Captain York asked the Secretary of State for Air whether he is aware that owing to faulty construction the runways of airfields, the names of which he has been given, have become unuseable; that several aircraft have been smashed up on landing because of the concrete being badly mixed; what was the name of the contractor employed on these airfields; and if this contractor has been given any further contracts by his Department?

Sir A. Sinclair : Following the very severe frosts of January and February last, defects developed in the runways in question. Some damage to aircraft has in consequence occurred, although no aircraft has been written off. The question how far, if at all, the contractor is liable is being investigated, and meanwhile I do not feel justified in giving the name of the firm or in any way prejudging the issue.



Three trainer types from E.C.F.S. in formation. Nearest the camera is a Miles Magister, next is a Master from the same stable and, in the background, an Airspeed Oxford.

A doctor of the Research Flight who flies with students of the school to study physiological effects under flying conditions.

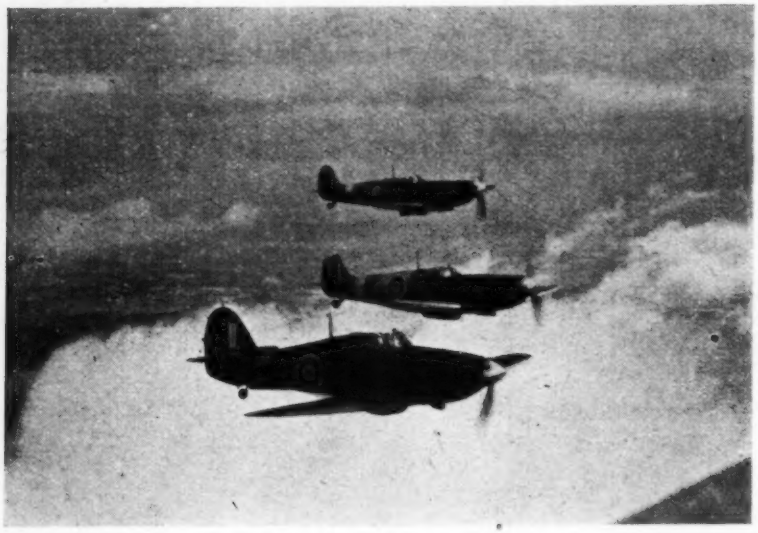
EMPIRE CENTRAL FLYING SCHOOL

Renowned Training Centre Receives Still Higher Status : 30 Years' History of a World-famous Unit

WRITING of a visit to the Central Flying School in July, 1914, the following passage appeared in *Flight*, summing up our impressions of a school which, even then, was famous:—"The organisation is complete in every branch of its work; the course of training leaves nothing to be desired, since theory and practice are combined in such proportions as to be of the maximum practical value to the officers and men; while the spirit which pervades the school is admirable." At that time the school was I.T.W., E.F.T.S., S.F.T.S., A.F.U., O.T.U., and C.F.S. rolled into one. To-day the students at the school consist mostly of chief flying instructors, each with over 2,000 hours' flying to his credit, so much have times changed. Nevertheless, the foregoing summary of the work and quality of the school is just as accurate to-day as it was 28 years ago.

Before describing the actual work of E.C.F.S. as constituted to-day, it is of interest to go briefly through the school's history. The Central Flying School was the first original unit of the Royal Flying Corps which, it will be remembered, had both naval and military wings. It came into being in August, 1912, and was stationed at Upavon, on Salisbury Plain. The unit still lives not many minutes by air from Upavon, but for a while—1926 to 1935—it was stationed on the Great North Road at Wittering, in Northamptonshire

EMPIRE CENTRAL FLYING SCHOOL



Flying 1942. Two Spitfires and a Hurricane of E.C.F.S. in formation.

At the time of its inception all *ab initio* training was carried out at civil schools, and officers who applied to join what was then the new arm first went to one of these civil schools to learn how to fly. This amounted to little more than learning to take off, fly a figure-of-eight, and land a box kite with a wing loading of about 3 lb. per sq. ft. Having satisfied the civilian authorities of their competency to fly, the pupils moved on to the Central Flying School of the Royal Flying Corps, where "wings" were granted, and then they became military or naval pilots. The first commanding officer of the school was Captain Godfrey Paine, R.N., who later became an Air Vice-Marshal, and his second-in-command was Major (now Lord) Trenchard.

The outbreak of the 1914-18 war seriously affected the strength of the C.F.S., and new pilots had to be trained in large numbers. The civilian schools ceased to function, and many of their instructors joined the Service and carried on the same work in uniform. It was obvious that no one school, however big, would be able to handle the whole of flying training for the expansion of the air services, and a number of other flying training schools were started as off-shoots from the original unit.

When this scheme had been in progress for some two or three years, the school at Upavon became a specialised unit for teaching air fighting, and was officially designated the Flying Training Establishment and Fighting School. This was found necessary because we were losing a considerable number of young pilots who had little or no knowledge of air-fighting tactics. The mantle of flying training then passed to the Special School of Flying at Gosport—commanded by Lt. Col. Smith-Barry—where the art of flying instruction was first systematised.

Previously anyone calling himself a pilot was considered a fit person to train the next man and, consequently, there were as many methods of instruction as there were instructors. The Gosport school altered all this, and while it was unable to train all the instructors needed to meet a war demand, it was able to train a sufficient number of them to pass on their training to others.

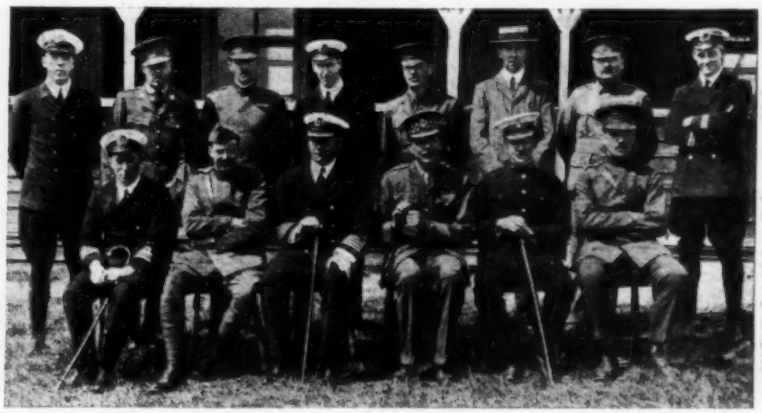
C.F.S. Resurrected

At the close of hostilities Gosport closed down and the much reduced demands for pilots enabled the resurrected Central Flying School at Upavon to take up ordinary flying instruction again, with a proportion of *ab initio* training in addition. Freed from the stress of war, the flying-training programme was mapped out more clearly, with a number of F.T.S.s all employing C.F.S.-trained instructors. The first course for instructors under this system was held in 1920.

A C.F.S. course has always been the coveted prize of a military pilot and, in the same way as a good "Martlesham" report was the hall-mark of a good aircraft, so an A1 certificate from C.F.S. was the hall-mark of a super pilot. Representatives of more than twenty nations have

"*Flight*" photograph.

Air Commodore G. S. Oddie, D.F.C., A.F.C., Commandant of the School, watching the flying from the balcony of the control tower.



"*Flight*" photograph.

C.F.S. group on the occasion of a visit by *Flight* in 1914. Major (now Lord) Trenchard is the third from the right in the front row wearing the uniform of the Royal Scots Fusiliers. He was assistant commandant of the school.

at various times studied flying at C.F.S. Names of officers making history to-day appear in the records as either having taken a course at C.F.S. or having been on the staff of the school. Some of these are:—Marshal of the Royal Air Force Sir John Salmond; Air Chief Marshal Sir Edgar Ludlow-Hewitt; Air Chief Marshal Sir W. R. Freeman; Air Chief Marshal Sir Philip Joubert de la Ferte; Air Chief Marshal Sir Arthur Longmore; Air Vice-Marshal A. Coningham, and Air Vice-Marshal J. E. A. Baldwin, who went with his men to Cologne on the first of the 1,000-a-night raids. Air Chief Marshal Sir W. Freeman and Air Vice-Marshal Baldwin have both been Commandants of the C.F.S., and two of the most famous fighter pilots of this war, Wing Cdr. Bader and Group Capt. V. Beamish, were students there.

In the old C.F.S. Mess at Upavon, photographs and trophies bore the names of pilots who have made flying history—men like Stainforth, Atcherley and Waghorn, and other members of the Schneider Trophy teams. There was the single gun from McCudden's machine with which he took so great a toll of German aircraft, and a wooden airscrew used by the Wright brothers in 1903. The airfield at Upavon, with his hump back and short landing and take-off runs, provided just sufficient hazard to provide good training in old-type aircraft.

"Flight" photograph.

Flying 1914. A C.F.S. scene at Upavon, with two Maurice Farman Longhorns on the ground and a Henry Farman in the air.

The scene now moves to the present day, when the training of air pilots for the Allied Nations has become such a world-wide organisation that C.F.S. has had the word Empire added, and its constitution changed for a kind of Air University or Training Staff College. Experienced instructors from Gt. Britain, New Zealand, Australia, South Africa, Canada and the United States come to E.C.F.S. to pool and gather knowledge of this all-important side of the war effort.

Many have personal experience of war flying. Some wear decorations won in fighting above the Libyan and Abyssinian wildernesses or flying from the decks of ships at sea, defending Malta or Greece. Bringing with them a knowledge of training and of war, and having access to the accumulated store of experience of stations in Great Britain, they meet to forge for the bomber and fighter pilot of the future an armoury of skill in operational flying, which will fit him to carry the battle to the enemy.

School Organisation

The commandant of the school is Air Commodore G. S. Oddie, who was C.F.I. at No. 3 F.T.S. from 1932 to 1936 and served for 14 months at the Air Ministry as Deputy-Director of Flying Training. He won the D.F.C. in the 1919 Afghan war, and the A.F.C. for experimental flying at the Royal Aircraft Establishment at Farnborough. The Chief Instructor, Wing Cdr. A. D. Selway, D.F.C., is an old C.F.S. man. He commanded No. 14 squadron in the East African campaign and has held staff appointments in the Middle East.

Typical E.C.F.S. group of 1942. (Left to Right) Lt. Col. Gent (U.S. Army Air Force); Sqn. Ldr. Roxburgh, A.F.C. (R.A.F.); Lt. Ball, D.S.O., R.N. (Fleet Air Arm); Major Boyle, D.F.C. (South African Air Force); Flt. Lt. Gale (Royal Canadian Air Force); Flt. Lt. Ruseicki (Polish Air Force).

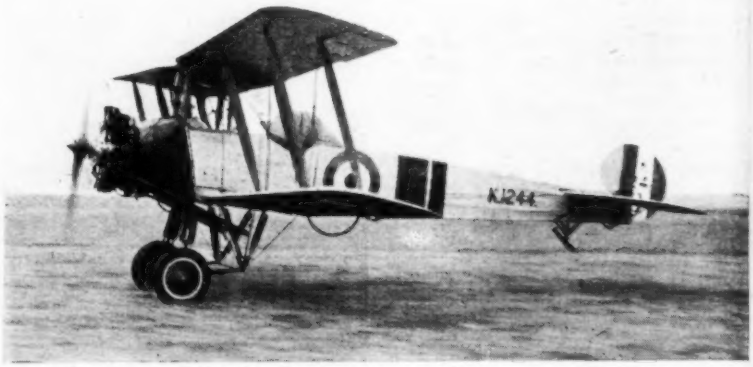
To gather some idea of the magnitude of the present-day air training programme, of which this school is the hub, it should be remembered that there are at present several specialised establishments whose sole purpose is to turn out flying instructors. It is self-evident that there is in existence a vast volume of data and experience of flying training methods and problems which have to be co-ordinated. Added to this, also, is the need for keeping flying training abreast of the times as new types and new devices come into operation. The organisation of the school is best thought of as a conference in permanent session, with the members continually changing. It has been provided with the means to try-out in the air the practicability of any of its findings.

Unlike the situation at the ordinary Flying Training Schools, where the teaching of flying is the basis of the course, the students at the Empire Central Fying School are very experienced pilots, and no question, therefore, arises of teaching them to fly. The ground work of this school forms

EMPIRE CENTRAL FLYING SCHOOL

the real basis of the whole course. The chief ground instructor, himself a pilot in the last war, has been in the Royal Air Force Educational Service ever since and has specialised in aeronautics, a subject on which he has written several books. He has played a prominent part in the technical training of the Royal Air Force at Henlow, Halton, Cranwell and Farnborough, and has experience of flying training both in this country and in the United States. He has even designed and built light aircraft for competitions.

In addition to all minor problems, which are considered as they arise, a main task is allotted to each course. At present the Empire Central Flying School is producing the key training publications which are required in the Training Organisation. The "Instructors' Manual" for elementary or primary flying training has just been completed for printing. The second part of this Instructors' Manual, which will deal with training at the S.F.T.S., is now being studied, and is expected to be in draft form by the end of the course.



"Flight" photograph.

An historic occasion while C.F.S. was at Wittering. Flt. Lt. W. E. P. Johnson on a Lynx Avro, making the first blind take-off. He took off, made a complete circuit, did two turns of a spin and came out exactly in position for landing before raising the hood. The only blind-flying instrument in the machine was a Reid and Sigrist turn indicator.

To produce these publications the staff and students are divided into committees in accordance with their particular experience. No detail is too small for consideration, and several conferences and hours of patient study may result only in the alteration of a few words in the syllabus of training by which all our war pilots are trained.

Conference Sessions

During a recent visit to the school we were able to attend one of these conference sessions. The subject under discussion was whether the flaps should be put down before or after the final turning into wind for landing. On the face of it, not a very deep problem to solve, but when thirty chief instructors gathered from the ends of the earth present all the possibilities, the need for the discussion becomes immediately apparent.

Here are just a few facets from the arguments. A method of approach which is quite suitable for the "open" airfields and good visibility of the United States and Canada is unsuitable for our small fields and our peculiar weather. Since operational flying will be done in Britain, the training in Canada must be carried out as if it were taking place in England. Then despite the type of machine flown in training, what would be advisable for the operational types? It may be of little consequence when the flaps are put down on an Oxford or Cessna, but make a lot of difference on a Lockheed Hudson. Again, the final decision must be influenced by considerations of night flying as well as day flying.

These and many other sides of an apparently simple question were thrashed out with a delightful frankness by representatives of the R.A.F., U.S. Army Air Forces, South African Air Force, Fleet Air Arm, Royal Canadian Air Force, Royal Australian Air Force, The Polish Air Force, and other Allied Nations.

The flying side is divided into five units, all of which, while each having its own special function, are complementary to the work of the Empire Central Flying School as a whole. First there are the Flying Flights, which are equipped with the standard elementary and advanced trainers to provide the means for studying the methods for teaching flying. Their work may, perhaps, be looked upon as the basis of the flying syllabus.

Then there is the Service Flight, which is equipped with a large variety of operational types. Its principal task is to see that all methods of teaching which are laid down for the training types are equally applicable to the operational types. It also provides excellent experience for those instructors who have been kept for long stretches on trainer types.

A Research Flight has also been established to study problems which cannot conveniently be investigated by the school as a whole. It carries out research locally on technical points in the training, such as the indications which enable a pilot to judge his landing. But when conducting research into such problems as pupil psychology, the flight directs from this school experiments which are carried out at schools holding a large pupil population.

To keep a finger on the training pulse, an Examining Squadron has been established. Its work is to visit flying instructors' schools and other flying schools to see that they are keeping up to date in their teaching, and obtaining all possible benefit from the work of the Empire Central Flying School.

E.C.F.S. Categories

On these visits the pilots tested are examined and assessed as to their instructional ability and then categorised into one of five groups:—A1: Exceptional; A2: Above average; B: Capable; C: With experience will prove a capable instructor. A1 is for all types, and the other categories may be applicable to elementary types, single-engined types or multi-engined types only. There is another category, Q, which is granted for specific aircraft. For instance, an operational pilot flying Lancasters may have a rest period at an O.T.U. If he holds a Q certificate he is qualified to teach pilots to fly Lancasters only. Another case is the glider instructors; they also hold a Q certificate.

Another flying branch is the Handling Squadron, which is equipped with all new types of aircraft as they come into use. Its work is to prepare, in conjunction with the Air Ministry, pilots' handling notes for these types. It is also responsible for visiting all operational units and making sure that they are fully conversant with any peculiarities of a new type, and to give them all the assistance they may require, especially when a squadron is being equipped with a new type.

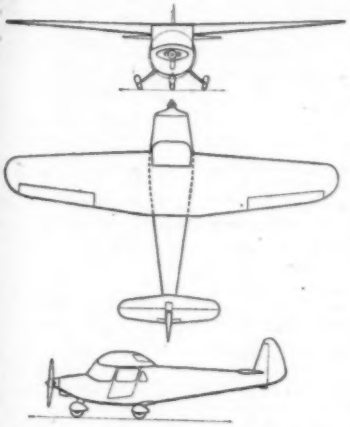
Although instructional flying in general suffers from the boredom of continually flying the same type in inexperienced hands, E.C.F.S. is just the reverse, for at their dispersal points will be found one of everything, from a Tiger Moth to the latest operational type.

BEHIND THE LINES

Service and Industrial News from the Inside of Axis and Enemy-occupied Countries

German Research

TO the many positions and honours bestowed upon Goering, Hitler has added yet another one. The Marshal has now been entrusted with the task of co-ordinating all German scientific research activities for the purpose of their exclusive application to the war. A new institution will be formed, which will function as a Research Council under Goering's chairmanship, and will be the liaison between the *Luftwaffe* and the different Aeronautical Research Institutes of the Reich.



Ambrosini S.A.1-II.—Its dimensions are : Span, 14.30m. ; Length, 7.25m.; and Height, 1.70m. Undercarriage legs have been kept short.

From Italy

THE *Societa Italiana Ing. A. Ambrosini and Co.*, of Rome, has produced a new two-seater high-wing cabin monoplane named Ambrosini S.A.1-II. The aircraft, which is a development of the S.A.1 trainer, is of composite construction, with the fuselage in welded steel tubing. The wheels of the fixed tricycle undercarriage have spats, the nose wheel is steerable, and undercarriage brakes are provided. Empty weight is 680lb., disposable load 460lb., total weight 1,140lb.

The aircraft is reported to have a maximum speed of 108 m.p.h., a cruising speed of 99 m.p.h., and a stalling speed of 38 m.p.h. Range is 225 miles.

Expensive Incident

WHILE the Japanese Imperial Headquarters claim to have destroyed, during the four years of fighting against China, 2,800 Chinese aircraft, their own losses are stated to have been only 240 aircraft. This is in good Axis tradition and the proportion strongly resembles German figures for their losses in Russia.

But the Chinese Central Government announced at Chungking that, since the opening phase of the "incident," the Japs have lost 2,504 aircraft. The Jap Air Force now engaged in China is said to have at its disposal about 1,000 machines.

Ago Aircraft

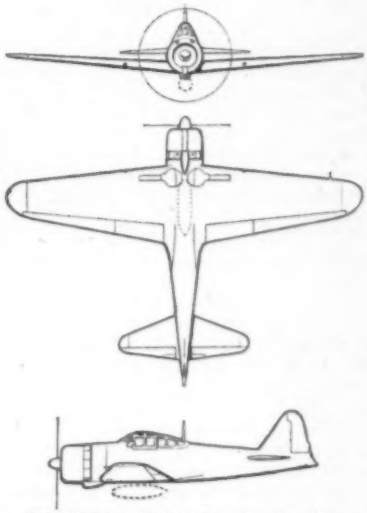
AMONG the German factories engaged on sub-contract work for the aircraft industry the *Ago Flugzeugwerke* is rapidly taking a prominent place. This firm, of which little has been heard hitherto, has been, until now, engaged mainly on the manufacture of components. Reports from Germany indicate that the Ago Aircraft Works at Oschersleben (district Boden) are now to take up the construction of aircraft, presumably on a sub-contract, for one of the larger German firms.

Japan's Fighter

FEW details are known of the Mitsubishi "OO" fighter of the Japanese Naval Air Force. Japanese pilots are understood to have instructions to crash or otherwise destroy the fighter rather than allow the outside world to learn something more about it. Recently, however, a specimen of the "OO" was captured in a slightly damaged condition, and from this the accompanying drawings have been prepared.

In the light of this information the picture published in *Flight*, September 3rd, would appear to have shown a new development of a Nakajima fighter. The new "OO" fighter seems to be a direct development of the earlier Mitsubishi fighters but with traces of American influence.

It is reported that two different power plants are used, a twin-row 14-cylinder Nakajima N.K.I. of 900 h.p. at 15,000 feet, or the well-known twin-row 14-cylinder Mitsubishi Kinsai of 1,000 to 1,200 h.p. The first version has a maximum speed of approximately 315 m.p.h. at 10,000 feet, and a range of 590 miles, the second version is said to reach a speed of 350 m.p.h. Service ceiling is approximately 36,000 feet, and flying weight 5,140lb.



Mitsubishi "OO"—Its span is given as 39ft. 5in., and its length 30ft. 3in. Its height is not stated.

Precise details of the armament are not yet available but it is reported to consist of two 7.7 mm. machine guns firing through a three-bladed airscrew, and two 20 mm. cannons in the wings.

A jettisonable fuel tank of wooden construction may be carried under the centre section for escort work or long distant raids. In this case armament is reduced.

From the dimensions given with the drawing it will be seen that they are approximate to those of the Hurricane. It is expected that this information, which cannot be considered as complete and final, will be shortly augmented by further details when more "OOs" become available.

BUMP WITHOUT CIRCUIT : The damage to the centre engine of this Savoia Marchetti S.M.79 suggests the reason for its "forced landing."

PLASTICS and AIRCRAFT

Part II of an Article on Their Composition, Manufacture, and Application

By W. NICHOLS, A.R.Ae.S.

IN Part I of this article were described the various resins, fillers and materials likely to be met with in the plastic group as applied to aircraft engineering. Of these the most common are "Acrylic" and "Venyl" (thermo-plastic) and "Phenol" (thermo-setting).

From what has already been written it will be realised that so far there is not a material available to the aircraft engineer by which a fuselage or wing could be moulded without the use of wood or metal. But with the aid of plastic resins the ideal is being approached, as will be seen later.

There is no plastic with which one could construct aircraft on the girder fuselage principle unless it be "Gordon-Aerolite," referred to earlier. Unfortunately this material has never been used outside of the laboratory. Its manufacture requires the use of linen as a reinforcement, and the manufacture of linen requires flax. In this war the demand for linen in other directions is already heavy, and the increased cultivation of flax is impossible at the moment, so this material also cannot be utilised for the present, but here again by the use of plastic resins and plywood a sound structural material is obtainable.

Plastics Specifications

The list of approved plastics or plasticised materials to D.T.D. specifications is a short one at present, but the majority are given hereunder and show that the aircraft engineer has not by any means a large choice of plastic materials whereby strategically important materials could be economised.

D.T.D. 216A.—Synthetic resin bonded fabric mouldings for magneto gear wheels.
D.T.D. 315.—Pigmented cellulose-acetate sheets.
D.T.D. 320.—L.T. varnished insulating tubing.
D.T.D. 339A.—Transparent synthetic sheets and mouldings.
D.T.D. 451 to 454 inc.—Synthetic resin (Phenolic) moulding materials and mouldings (various shock resistance).

To this may be added

D.T.D. 370.—Laminated compressed wood.
D.T.D. 427.—Plywood—lightly stressed parts, and
5V3.—Birch plywood impregnated and resin bonded materials.

The list is not complete, but these are the materials already in common use.

The purpose here is to deal with the manufacture and fabrication of the more important plastic materials used in the construction of aircraft and components, and to give some idea of what can be accomplished by the use in combination of plastic resins and plywood, wood veneer, fabric, etc.

From the list of specifications just given probably the most commonly used is D.T.D. 339A, known in this country under the trade name of "Perspex"; a similar material used in America is known there under the original German name "Plexiglass." This transparent material is one of the best so far obtained from the plastics industry and has been used extensively for windscreens, cabin hoods, windows, and landing light covers. Perspex or Plexiglass is even more transparent than glass and retains this superior transparency in spite of the effects of sun and weather in extremes of temperature and humidity such as aircraft operating with the Services are now subjected to.

The impact strength is superior to that of glass, though this plastic material is lighter in weight. As a thermo-plastic it adapts itself to being conveniently formed to two- or three-dimensional sections, an essential feature if good aerodynamical shape is to be obtained. Mounting this material either as a windscreen, hood, or cover presents no difficulty if certain rules are observed, and bracings or supports which might become necessary with glass can be dispensed with to some extent and vision thereby improved.

Perspex can be obtained in sizes to suit nearly all requirements and in various thicknesses, as follows:

Thickness	Tolerance
$\frac{1}{32}$ in.	$\pm\frac{10}{1,000}$
$\frac{1}{16}$ in.	$\pm\frac{12}{1,000}$
$\frac{5}{32}$ in.	$\pm\frac{14}{1,000}$
$\frac{3}{16}$ in.	$\pm\frac{16}{1,000}$
$\frac{7}{32}$ in. and over	$\pm\frac{20}{1,000}$

Nowadays sheets can also be obtained in other thicknesses to assist production, such as

$\frac{9}{64}$ in. in lieu of $\frac{1}{8}$ in.
$\frac{11}{64}$ in. in lieu of $\frac{5}{32}$ in.
$\frac{13}{64}$ in. in lieu of $\frac{3}{16}$ in.

Tensile strength from the specification is given as not less than 2.75 or more than 4.25 tons per sq. inch.

Manufacture

Considerable care is necessary. Starting with a flat "cast" sheet protected from dust or foreign matter which might later cause distortion of vision, the sheet is hung vertically in a hot-air oven. Small areas may be immersed in hot oil or glycerine. At a temperature of from 220 deg. F. to 250 F. the sheet becomes pliable, but can be handled by operatives wearing gloves.

Above this temperature the sheet becomes very soft,

A Wadkin router makes a good tool for cutting and trimming the edges of synthetic transparent sheets, also Plasti-ply to be referred to later.

PLASTICS AND AIRCRAFT

and is then apt to form into small wrinkles or waves. Obviously, the forming must be done rapidly whilst the sheet is still pliable, for if the sheet cools and force is used to enable it to conform to the mould, the strength of the material may be affected. For three-dimensional forming, stretching may have to be resorted to, or the better system of "pressing" the sheet between a male and female mould. When cool the sheet is taken from the moulds and trimmed. Should reinforcing strips of the same material be called for, these can now be cemented to the main unit.

Manipulation

Moulds.—The moulds are generally of wood, but sand and plaster are used, and also a combination of the three. In either case the surface must be quite smooth, and covered with flannel or felt to avoid any possible cause of roughness.

Cutting or Trimming.—This operation is frequently done on a "router," but if hand-trimming is done a fine-toothed saw is ideal for the purpose. A saw with coarse "set" should not be used.

Drilling.—Care is required in this operation. It is advised that the drill be ground parallel to the drill axis at the cutting edge to eliminate "lead." Light pressure is all that is necessary when the drill penetrates the material to prevent the possibility of "grabbing."

In other operations, such as machining or buffing, the sheet will soften if the heat caused by friction is allowed to increase locally, and as a result tools will become "gummed" or "tacky."

Mounting.—A flat or curved section of less than a 45-deg. arc could be conveniently mounted within light-alloy channels without the use of bolts, but for aircraft work this should be avoided, since the air pressure might pull the Perspex out of the channels.

The joint between the sheet and channel requires packing with rubber sheet and composition to ensure watertightness, and to take up any dimensional variations in the sheet or metal channel due to temperature changes.

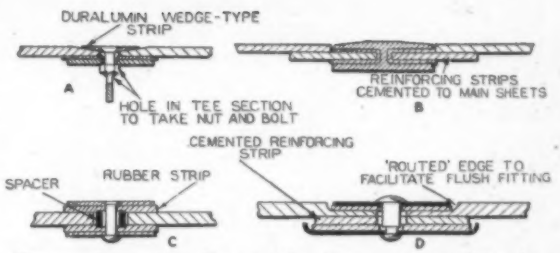


Fig. 1. Suggestions for mounting transparent acrylic resin sheet. A, standard extruded T-section support. Edges of sheet bevelled. B, aluminium H-section for joining sheet. C, spacer around rivet to prevent excessive clamping stresses being set up in sheet. D, two sections joined together, shouldered rivets being used. Thus the hole in the outer metal strip is larger diameter than inner, preventing drawing the metal too tightly against sheet, and also allowing for expansion and contraction.

When mounting this material allowance must be made for thermal expansion, and for this reason the sheet should always be slightly undersize. For the same reason bolt or rivet holes should be drilled oversize.

Where a large area is to be mounted it is sometimes convenient to bolt the section at one end only, allowing for expansion at the other or opposite end; or as an alternative, bolting the section at the centre, thereby allowing for the expansion at each end. The oversize bolt-holes need to be concentric with those in the frame to ensure that neither bolt nor rivet will bend, causing concentrated stresses at such points.

Using high pressure when bolting or riveting should be avoided, as this may produce very fine cracks upon the surface of the sheet, weakening the plastic and reducing the transparency. Shouldered rivets or tubular spaces a few "thou" larger than the sheet thickness can protect the plastic from pressure. Some examples of how this plastic may be mounted are shown in Fig. 1.

It now remains to be seen what can be done by the combination of plastic resins with other materials such as wood veneer, plywood and fabric-laminated compressed wood to Spec. D.T.D. 370 is used for the construction of some smaller types of aircraft, but there is still room for improvement in this material for it has a rather high moisture content. In any case, where used the construction follows normal woodworking practice.

In describing so far the most advanced stage towards the ideal moulded aircraft by the use of resin adhesives and wood veneers or plywood, the principles involved are not altogether new, but the method of applying the necessary pressure as well as the unusually large size of the moulded unit are the latest and most novel features in this development.

Briefly, the fundamental principle involved is using an "inflated" or "deflated" rubber bag as one of the halves of a pair of moulding dies. By this means there is not only the saving in matching-up a pair of dies where the intermediate distance between halves must be very accurately determined, but in some cases the dies can be entirely eliminated. The rubber-bag principle of applying the pressure is ideal inasmuch as it is of the same order as "fluid" pressure: at right angles to any surface under pressure. The best known of these processes in the United States of America are the "Duramold,"

The Langley twin-engined monoplane was built in accordance with the Vidal process. Even the engine nacelles are made of plastic-bonded plywood.

PLASTICS AND AIRCRAFT

"Turin" and "Vidal" processes, all of which use the rubber-bag pressure principle, and the Americans are rapidly proving that by these means wood and plywood present many new and still undeveloped possibilities in the aircraft industry.*

One of the latest examples of an aircraft produced by this process is the twin-engined Langley, a photograph of which is reproduced. Practically the whole of this aircraft is of moulded sections, the fuselage being made in two portions divided on the vertical centre line. The engine cowlings and nacelles are also of moulded plywood and made in two sections. Vinyl resins are not as a rule used as an adhesive for aircraft plywood, phenolic being preferred, but the Langley machine departs from this practice, and after exhaustive tests the designers decided upon vinyl resins as being the most satisfactory over the required temperature range of −40 deg. C. to +160 deg. C. Apart from being fire-resistant, they are also not liable to suffer from corrosion from acids, petrol, or sea water. Being thermo-plastic, they can also be reworked upon application of heat in contrast to phenol (thermo-setting); this can assist materially in maintenance and repairs.

Duramold Process

This process was brought into prominence a few years ago by a well-known aircraft engineer and designer, Col. Virginius Clark, and further information was given by him before the World Engineering Congress of the S.A.E., New York, early in 1939, from which the following properties were claimed for this material.

Duramold Type	Direction of Applied Load	Tension	Comp.	Young's Mod. T and C.
I	Optimum	27.75	13.95	3,060
I	90° to Optimum	4.72	7.7	714
II	Optimum	22.73	13.03	2,730
II	90° to Optimum	7.75	8.6	1,053
III	Optimum	19.69	12.08	2,380
III	90° to Optimum	10.8	9.51	1,395
IV	Optimum	16.75	11.22	2,040
IV	90° to Optimum	13.87	10.40	1,732

Shear optimum 10.4.

This table shows the approximate values for Duramold in lb./sq. in. divided by (1,000 × specific gravity of material). It is probable that they have been improved upon to some extent since. For purposes of comparison Col. Clark calculated the strengths of four cylinders with different types of construction. In each case the dia. was 60in., weight per foot run constant, and the space between transverse frames was 30in. It was claimed that such a cylinder with a smooth skin of aluminium alloy 0.032in. thick, reinforced by flanged "Z" section longitudinal stringers ⅜in. × ½in. × 0.050in., with spacing of 6in. and a total stiffener area of 3.23in., would support a load of 63,000 lb. The same cylinder unstiffened would support 30,000 lb.

A cylinder of reinforced synthetic resin (Bakelite with fabric or cord) would support 8,000 lb.

A Duramold cylinder of material between types II and III in table would support 113,000 lb., or 14.1 times as much as the plastic cylinder, and 80 per cent. more than the reinforced high-strength aluminium-alloy cylinder.

Other claims were that its energy-absorptive characteristics were excellent, and its damping in vibration about five times that of metal.

According to calculation based on wind-tunnel tests at fairly high Reynolds Numbers, the use of Duramold for fuselage, wing and tail units results in about 25 per cent. less power being required for a given top speed, compared with an all-metal aircraft with projecting rivet heads, lap joints, waves and wrinkles, etc. Samples tested for reaction to sharp changes of temperature showed no signs of serious change.

Briefly, the Duramold process employs a polished sheet-metal mould. Veneers are built up inside the mould to required thicknesses, and the assembly then covered with a rubber blanket which is secured to the edges of the mould. The procedure thereafter is somewhat similar to the Vidal already mentioned. Air is exhausted from beneath the rubber blanket, and the entire assembly, including the mould, is inserted into an autoclave, where it becomes subjected to steam heat and pressure, i.e., about 300 deg. F. and 100 lb./sq. in. The mould being of thin material, heat penetrates to the plywood from both sides, and the pressure is also balanced.

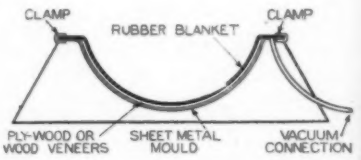


Fig. 2. Diagrammatic arrangement of "Duramold" process, with sheet-metal mould in conjunction with rubber blanket.

The moulding or curing period varies with the thickness of the plywood, but it is stated to be from 10 to 15 minutes for units of ⅛in. in thickness.

Phenolic resin fluxing at about 280 deg. F. is used as a binding agent. It will have been noticed that in this process the outer side of the wood veneers is in contact with the smooth, unyielding metal mould, resulting in a high and superior surface finish.

Structural members, such as ribs and spars, are also made by this process, and one of the great advantages is that the higher quality and superior material can be used where greatest strength is required, with consequent economy in cost.

It has been recently reported that a large transport aircraft is now under construction by the Duramold process in America, and, further, that a large number of trainers are also being constructed of Duramold.

Although only the Vidal and Duramold processes are described here there are, of course, others, but they are all somewhat similar, and need not, therefore, receive further consideration here. In Fig. 2 is shown diagrammatically the Duramold system herein described.

In describing the above two systems it will have been observed that the material is comprised of wood-veneers, and though referred to as plywood is not in the true sense plywood, such as manufactured to Spec. 5.V.3 or D.T.D. 427.

However, even this material can be manipulated by similar processes. One thing, however, crops up as a result of the war. Due to the high temperatures used, the rubber bag or blanket will deteriorate in time. At the moment we have to economise in rubber, and experiments are now being made to pre-treat the ply or veneer with a mild thermo-setting resin, and then carry out the operation as described at a lower temperature. In this respect the ideal has not yet been achieved, but experiments continue to give promising results.

The bonding of wood veneers by the aid of plastics can be used to great advantage in the aircraft industry, and it is safe to assume that in the near future metal will be bonded to metal, dispensing with riveting and with almost endless possibilities to the aircraft engineer.

Due to the recent research work of Dr. N. A. de Bruyne, metal is already being bonded to a transparent plastic in a simple and certain manner, and the process can be used in conjunction with any plastic (thermo-setting or thermo-plastic).

It is hoped that in a later review this great step forward can be described. For the present, however, this article will be continued by dealing with further applications of plywood and plastics, and with other plastic materials.

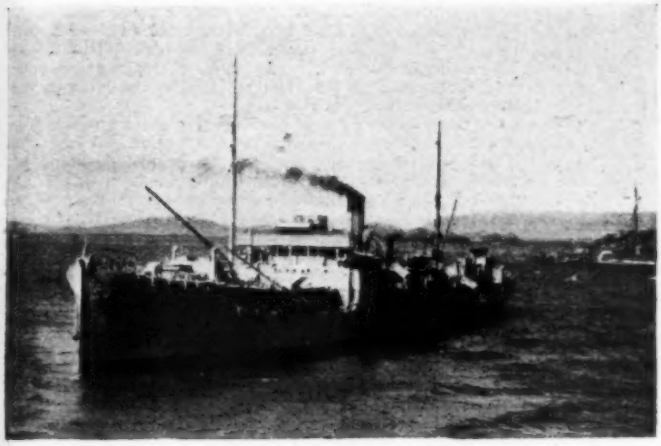
(To be continued next week.)

* The Vidal process was described in our issue of September 10th, 1942.

GUARDING THE NORTHERN ROUTES

The Fleet Air Arm is to be Found Wherever There is Work to Do

Not so complicated as it looks. Getting a Fairey Albacore ready for patrol.

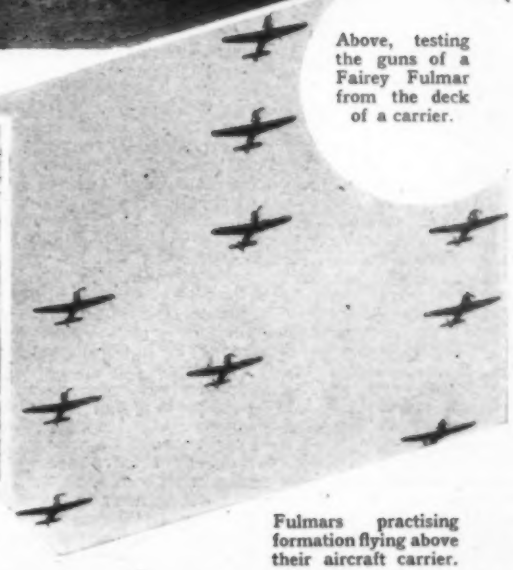


Royal Fleet auxiliaries keep the Fleet supplied in all weathers. Above, the R.A.F. oiler *War Bharata*.

Officers of the Fleet Air Arm exercising on the flight deck of an aircraft carrier.

Above, testing the guns of a Fairey Fulmar from the deck of a carrier.

Every opportunity is taken for training. Above are Fairey Albacores carrying out practice attacks with smoke bombs.



Fulmars practising formation flying above their aircraft carrier.

Correspondence

The Editor does not hold himself responsible for the views expressed by correspondents. The names and addresses of the writers, not necessarily for publication, must in all cases accompany letters.

INTERNATIONAL AIR POLICE

What About Russia and China?

YOUR correspondent, Mr. J. K. Carter, in his letter advocating an Anglo-American Air Police Force (*Flight*, September 10th) appears entirely to overlook the part which China and the Soviet Union are playing in the destruction of Fascism and the fight for freedom.

The Soviet Union might well be suspicious of an I.A.P. controlled by the Anglo-Saxon democracies, since there would be no guarantee that an unfriendly government would not use it for ulterior motives.

If an I.A.P. is to be effective it must be genuinely international. W. H. RIDER.

Rights of Other Nations to Participate

I SHOULD like to say a few words to your correspondent, Mr. J. K. Carter, who suggests an Anglo-American Air Force to police the world, after this war.

Perhaps he can explain what part (if any) the U.S.S.R. would be given in this organisation, also China, whose heroic people "of whom we knew so little" were fighting Fascism when the Munichites—in full power in this country—were indirectly and in some instances directly helping to build up Fascism throughout the world. Are these two great countries to have no part in the international sphere after this war?

Although to-day Munich is "officially" dead its followers linger on, and how can we guarantee that never again will their policies rule us? I cannot believe that the Abyssinians, Czechs and Spaniards, who have paid the full penalty of Munich to Fascism, would be very ardent in their desires to see such a coalition of armed forces in being, without their own full representation and co-operation in it. In any case I suggest that the final word in this matter will come from the U.S.S.R. who are fighting for the liberation of all peoples and who offer equality to all, irrespective of their colour, race or creed. Their actions to-day at Stalingrad give them the undeniable right to participate. L. A. BRIGHTMAN.

TEST PILOTS

Uniform Training a Better Solution

YOUR correspondent, "Test Pilot," and your editorial comment (*Flight*, September 10th) have raised an interesting point concerning our often misrepresented profession. Are we sufficiently independent to give an unbiased opinion? I am perfectly certain in my own mind that the majority of us are, but whether anyone chooses to take our criticisms of aircraft to heart is another matter.

Before lumping all test pilots together as such, it should be realised that out of every hundred not more than twenty test pilots are what may be termed "first-class" and have the necessary experience and skill for handling prototypes or doing any type of experimental flying. The remainder are the stooges who handle the flow of production aircraft—a most important though often tedious business.

Those who have attained the status of a "first-class" test pilot have always been able to maintain a very high standard of independence in their judgment and have been the most valuable link between the aircraft industry and the R.A.F. They have almost all been in the Service themselves, and no one could have a more sympathetic outlook on the requirements of the Service pilot than they. The fact that the drawing office does not always respond to the test-pilot's criticisms and that the management does not always give him the backing he deserves detracts not one iota from the honesty and fairness of the test-pilot's opinion.

In other words, so far as the pilot's independence with prototypes is concerned, it would be difficult to improve on present arrangements. Even in the matter of experience with the current types produced by competitors, whereas a few years ago firms' test pilots used to work in water-tight compartments, to-day more opportunities have been given to them to fly types other than those made by their own firms. Still more could be done in this respect no doubt, but it could be achieved just as well by temporary swapping and not by permanent pooling.

Your correspondent points out that some firms prefer the easy "passers-off of aircraft" for production testing. This may be true, particularly where production lags, and the production manager whose life depends on numbers wants to see the greatest number of aircraft put off test in the shortest possible time. This is a natural wartime evil. But if the pilot's standing is not high enough with the management for him to resist having his hand forced, that is the fault of the individual rather than of the system.

A more likely cause of easy passing-off is sheer ignorance or a non-technical outlook on the part of the pilot. This is due to the lack of a recognised centre of instruction for test pilots.

A school for test pilots is just as important as a C.F.S. for instructors in the Service; otherwise there can be no uniformity. The centre would have to be divided into two parts, one for land aircraft, the other for marine. Various categories of aircraft—fighters, army co-operation machines, medium bombers, heavy bombers, civil aircraft (light or heavy)—would have to be covered, and the student would have to choose his type or types according to the requirements of his job.

The first requirement in any candidate would be that outlook balanced between the mechanical and the theoretical, without which no amount of training can produce a successful test pilot.

So much for the education of production test pilots. How soon a pilot should be allowed to graduate to prototype work must vary according to type. Probably 100 hours' production testing would be sufficient in the case of trainers or small civil craft, but for multi-engined aircraft or flying-boats something more like 500 hours' production flying would be a minimum.

Whilst I entirely agree with your correspondent that test pilots are not on a satisfactory footing under the existing régime, I shudder at the suggestion of making us all civil servants or of pooling us like so much petrol. What we really need is more uniformity in education—and wages as well—and I think the scheme I have mentioned would not be found impracticable if the Air Ministry could be persuaded of its advantages. A. N. OTHER.

TRICYCLE UNDERCARRIAGES

Anti-shimmy Devices

"PRO-TRIKE," supporting the tricycle undercarriage in your issue of the 17th inst., is perhaps a little too enthusiastic in claiming that the arrangement should be lighter than the conventional.

Reduction in weight for the rear fuselage structure cannot be greatly affected by the absence of the tail-wheel unit; there are important aerodynamic loads still present due to the control surfaces forming the empennage. The great advantage of the "trike" is surely "happier landings," where for certain types of aircraft the arrangement is ideal. Tail wheels and front wheels do certainly suffer from "shimmy," but by suitably placing the wheel, aided by anti-shimmy devices, its effect can usually be overcome satisfactorily. T. SQUARE.

FUEL CONSERVATION

Running-in Aircraft Engines

I HAVE been interested in the recent correspondence in your journal concerning fuel conservation in aircraft engine testing. It is well known, of course, that an aircraft engine is tested on a dynamometer for b.h.p. and other data, but I ask you, is it really necessary to continue to run the engine at more or less full throttle for hours on end simply for running-in?

The energy released by the dynamometer shaft could be utilised to drive a dynamo or dynamos and these in turn used to charge storage cells. The power then stored could be used as follows. The engine could undergo its normal dynamometer tests and then, instead of running the engine on fuel for running-in, the storage cells could be used, through the medium of electric motors, to drive the engine during its running-in period, which is really only to wear off the tightness. Surely this would be more economical than using the generated power to drive other machines in the factory. If anyone doubts this I should say, "Which is the more valuable in wartime, petrol or electricity, and which is the easier to produce?"

STUDENT.

A fine side view of the Hercules-engined Bristol Beaufighter I which has given the R.A.F. such excellent service as a long-range fighter and night fighter. Being cannon-armed it is also used extensively for ground strafing and attacks on shipping.

Service Aviation

Royal Air Force and Fleet Air Arm News and Announcements

Air Efficiency Award

THE KING has been graciously pleased to institute a medal in recognition of long and meritorious service in the Auxiliary and Volunteer Air Forces of the Empire.

The award will be available for officers and airmen, and will be entitled the "Air Efficiency Award." The ribbon, which will be dark green, one inch and a half in width, with two narrow central stripes of pale blue, will be available to qualified claimants. The medal itself will not be issued during the war, and the design will be considered on its conclusion.

Members of the Auxiliary Air Force and Royal Air Force Volunteer Reserve will be eligible if they comply with the detailed conditions and provided their service commenced before the 4th September, 1939. The conditions applicable to those who joined on or after the 4th September, 1939, and continue in the post-war non-regular air forces, will be considered after the war.

The main qualification for the award is ten years' efficient service, but air crew personnel who have served a minimum of five years actual time may count their service as time and a half.

Enquiries regarding the award from former members of the Auxiliary Air Force and the Royal Air Force Volunteer Reserve not now serving on the active list should be made to the Under Secretary of State, Air Ministry (S.10A), Kingsway, London, W.C.2, for officers, and to the Air Officer-in-Charge-of-Records, Royal Air Force, Gloucester, for airmen.

Awards

Malta Convoy

THE KING has been graciously pleased to approve the following awards:—

For bravery and resolution in H.M. ships while escorting an important convoy to Malta:—

DISTINGUISHED SERVICE ORDER.

Act. Temp. Lt. Cdr. (A) R. A. BRABNER, M.P., R.N.V.R.

DISTINGUISHED SERVICE CROSS.

Temp. Sub Lt. (A) G. W. PARISH, R.N.V.R.

DISTINGUISHED SERVICE MEDAL.

Chief Air Artificer F. E. MERWOOD.
Ldg. Air Mech. J. A. HUMPHRIES.
Ldg. Air Mech. W. J. SOUTER.

For skill and resource when H.M.S. Eagle was flying off fighter reinforcements for Malta:—

O.B.E. (MIL.).

Wing Cdr. J. S. McLEAN, D.F.C., R.A.F.

For good services in H.M.S. Eagle when she was flying off fighter reinforcements to Malta:—

MENTION IN DESPATCHES.

Sqn. Ldr. H. V. HUGHES, M.B.E., A.F.M., R.A.F.
W/O. D. A. CONNORS, R.A.F.

Act. Sqn. Ldr. C. G. Peterson, D.F.C., No. 71 Squadron, who has been awarded the D.S.O. He has since been appointed executive operational officer of the new American Fighter Group.

THE KING has been graciously pleased to approve the following awards in recognition of gallantry displayed in flying operations against the enemy:—

DISTINGUISHED SERVICE ORDER.

Act. Wing Cdr. J. M. N. PIKE, D.F.C., No. 248 Sqn.—This officer is a gallant and skilful leader. By his untiring efforts and unceasing devotion to duty he has played a large part in the splendid work accomplished by his squadron. In August, 1942, he led a formation in an attack on airdromes in Sardinia. In spite of heavy anti-aircraft fire, a large number of enemy aircraft were destroyed and damaged. Wing Cdr. Pike's careful planning before the flight and his brilliant leadership during the sortie contributed materially to the success achieved.

Wing Cdr. P. R. WALKER, D.F.C.—This officer, who has completed numerous sorties since April, 1942, has won, by his meticulous planning and forethought, combined with his great skill and tenacity in action, the complete confidence of his fellow-pilots. In the recent Dieppe operations Wing Cdr. Walker led formations of aircraft on two sorties. Throughout his operational career he has displayed the highest standard of devotion to duty. He has destroyed eight enemy aircraft.

Act. Wing Cdr. F. D. S. SCOTT-MALDEN, D.F.C., R.A.F.V.R.—During the past six months this officer has led the wing on a large number of sorties. In this period the wing has destroyed 49 enemy aircraft and probably destroyed or damaged many others. During the combined operations at Dieppe on August 19th the wing completed a large number of sorties; 21 enemy aircraft were destroyed and many others damaged. Wing Cdr. Scott-Malden led the wing on three of these sorties. The splendid success achieved on this and other occasions is largely attributable to the magnificent leadership displayed by Wing Cdr. Scott-Malden. He is a brilliant pilot and a fine tactician, whose thorough knowledge and personal example have proved worthy of the highest praise.

Sqn. Ldr. W. G. G. D. SMITH, D.F.C. and Bar, R.A.F.V.R., No. 64 Sqn.—Since being awarded a Bar to the D.F.C. this officer has completed a great number of sorties. He is a brilliant pilot and a fine leader whose skill has proved a source of inspiration to all. Sqn. Ldr. Smith has destroyed ten and probably destroyed several other enemy aircraft.

Act. Sqn. Ldr. C. G. PETERSON, D.F.C., R.A.F.V.R., No. 71 (Eagle) Sqn.—This officer has completed a large number of sorties over enemy-occupied territory. He has at all times displayed high qualities of leadership and courage which have contributed materially to the fine fighting efficiency of his squadron. During the operations over Dieppe Sqn. Ldr. Peterson destroyed a Ju. 88, bringing his

SERVICE AVIATION

victories to six. His devotion to duty has been outstanding.

Act. Sqn. Ldr. R. H. THOMAS, D.F.C., ..A.F.V.R., No. 129 (Mysore) Sqn.—Since being awarded the D.F.C. this officer has completed many sorties over enemy territory. He is a fine leader and a tenacious fighter. In June, while escorting a force of bombers from an attack on Le Havre, his skilful tactics frustrated the efforts of 12 F.W. 190s to engage the bombers. In the ensuing engagement three of the enemy's aircraft were destroyed without loss. In August he led a daring and determined attack on a number of enemy float-planes, which were destroyed, despite the presence of enemy fighters. The next day, in low-level attacks on certain positions during the combined operations on Dieppe, Sqn. Ldr. Thomas's magnificent work won the admiration of the attacking Commandos. This officer is an outstanding squadron commander, whose great skill and faultless judgment have contributed materially to the many successes achieved by his squadron.

BAR TO DISTINGUISHED FLYING CROSS.

Sqn. Ldr. G. A. DAYMOND, D.F.C., R.A.F.V.R., No. 71 (Eagle) Sqn.—Since being awarded the D.F.C. this officer has completed very many sorties over enemy territory. He had always led his flight with great skill and courage and has destroyed seven enemy aircraft. In the recent Dieppe operations Sqn. Ldr. Daymond flew with distinction.

DISTINGUISHED FLYING CROSS.

Act. Sqn. Ldr. M. J. P. MARTIN, No. 200 Sqn.
P/O J. QUINN, R.A.F.V.R., No. 204 Sqn.
Lt. E. T. STREVER, S.A.A.F., No. 217 Sqn.
P/O. W. M. DUNSMORE, R.A.F.V.R., No. 217 Sqn.

Lt. Strever, P/O. Dunsmore and Sgts. Brown and Wilkinson were the crew of an aircraft which operated from Malta in June and July, 1942. During this period they performed excellent work in attacking enemy merchant vessels and naval forces, and all displayed initiative, courage and devotion to duty of the highest order.

P/O. J. B. MAHON, R.A.F.V.R., No. 121 (Eagle) Sqn. (since missing).—This officer has participated in a large number of sorties over Northern France, Belgium and Holland. He is an extremely skilful and confident pilot, whose courage, especially when attacking superior numbers of hostile aircraft, has been unsurpassed.

P/O. R. C. MUNSON, R.A.F.V.R., No. 150 Sqn.—One night in August, 1942, this officer was captain of an aircraft detailed to attack Mainz. Whilst crossing the enemy coast on the outward flight, the aircraft was hit by anti-aircraft fire, sustaining damage to the port wing and the fuselage; several electric circuits also failed. In spite of this, P/O. Munson resolutely flew on to his target, where he pressed home his attack. On the return journey his aircraft was attacked by a hostile fighter. The rear gunner was killed, the wireless operator wounded and the aircraft sustained further damage. The starboard engine was hit and various instruments, including the airspeed indicator, were put out of action. The controls became temporarily jammed but after a great effort P/O. Munson managed to free them and decided to make an attempt to fly the aircraft back to this country. He eventually reached the English coast where he was compelled to effect a crash landing. This he did successfully in spite of difficulties. By his skill, courage and determination this officer surmounted a most perilous situation, thereby safeguarding the lives of his crew and much valuable equipment.

Wing Cdr. M. G. F. PEDLEY, No. 131 Sqn.—This officer has participated in 38 operational missions, including shipping reconnaissances. During the combined operations at Dieppe on August 19th he displayed great keenness and a fine fighting spirit. In the evening, when the enemy attempted an air attack in the vicinity of one of our airfields, they were intercepted by the squadron led by Wing Cdr. Pedley; at least two enemy bombers were destroyed. This officer is a squadron commander of outstanding ability.

Sqn. Ldr. C. J. FEE, R.C.A.F., No. 412 (R.C.A.F.) Sqn.—This officer is a fine pilot and a skilful leader. By his outstanding ability he has been mainly responsible for the high standard of fighting efficiency of the squadron he commands. He has completed a large number of sorties, including some during the combined operations at Dieppe. Sqn. Ldr. Fee has at all times set a most inspiring example.

Act. Sqn. Ldr. R. W. IREDALE, R.A.A.F., No. 114 Sqn.

F/O. J. L. MCCAUL, R.C.A.F., No. 114 Sqn.—One night in July Sqn. Ldr. Iredale and F/O. McCaul were pilot and navigator respectively of an aircraft detailed to attack an enemy airfield. Whilst over the target area intensive searchlight activity and anti-aircraft fire was encountered. Sqn. Ldr. Iredale defied the opposition and bombed the airfield, obtaining hits on the runway in use. Throughout the operation Sqn. Ldr. Iredale was greatly assisted by F/O. McCaul, whose accurate navigation in the face of great difficulties was of the highest order. Both these officers displayed great courage and determination.

Act. Flt. Lt. P. L. I. Archer, R.C.A.F., No. 416 (R.C.A.F.) Sqn.—This officer has completed a large number of sorties over enemy territory and has destroyed at least four enemy aircraft. On one occasion, although wounded in the leg, Flt. Lt. Archer flew his badly damaged aircraft back to base, where he executed a skilful landing. He is a most efficient leader.

Act. Flt. Lt. F. E. GREEN, R.C.A.F., No. 412 (R.C.A.F.) Sqn.—This officer has participated in numerous sorties over enemy territory and has destroyed at least three enemy aircraft. During the combined operations at Dieppe, he completed three sorties, two of which were low-level escort duties. Flt. Lt. Green has invariably displayed high skill and great determination.

Act. Flt. Lt. W. GREGSON, R.A.F.V.R., No. 124 Sqn.—This officer has participated in a large number of sorties, including four executed in the combined operations at Dieppe, when he led his flight with skill and courage. He has at all times set a splendid example. Flt. Lt. Gregson has destroyed one and damaged other enemy aircraft.

Act. Flt. Lt. A. T. LEANING, R.A.F.V.A., No. 39 Sqn.—This officer has performed excellent work in attacks on enemy shipping. In March, 1942, he participated in an attack on a convoy of merchant vessels, escorted by naval units. Several hits were obtained on one of the naval vessels. Following the action Flt. Lt. Leaning became detached from his section. His aircraft was attacked by several hostile aircraft, but he met them with resolute fire until they broke away. In April, 1942, he took part in another attack on a convoy. When near the target, a force of about 100 enemy fighters was encountered. Undaunted, Flt. Lt. Leaning flew in through a continuous attack, released his missile and fought off the fighters to get clear of the target area. This officer is a gallant and resolute pilot whose keenness has set an example worthy of the highest praise.

P/O. M. P. KILBURN, R.A.F.V.R., No. 124 Sqn.—This officer has participated in a large number of operational sorties. During the recent Dieppe operations, P/O. Kilburn participated in four sorties. He is a skilful pilot who has destroyed at least two and damaged several more hostile aircraft.

P/O. J. W. WILLIAMS, R.C.A.F., No. 249 Sqn.—This officer has fought the enemy with great determination. Within a short period he has destroyed at least four enemy aircraft, two of which he shot down in one day. Later, his aircraft was damaged by enemy fire but he flew it safely to base. His courageous example has been most inspiring.

Act. Flt. Lt. R. H. HARRIES, R.A.F.V.R., No. 131 Sqn.—This officer, who has completed numerous sorties, is an excellent flight commander. He has spared no efforts in the training of his pilots, amongst whom he has fostered a fine team spirit. He has destroyed one and assisted in the destruction of two more enemy aircraft.

DISTINGUISHED FLYING MEDAL.

Sgt. A. R. BROWN, R.N.Z.A.F., No. 217 Sqn.
Sgt. J. A. WILKINSON, R.N.Z.A.F., No. 217 Sqn.

For citations see Lt. Strever and P/O Dunsmore.

Flt. Sgt. J. E. ELLIOTT, R.A.A.F.—One night in July, 1942, this airman was captain of an aircraft detailed to attack Dusseldorf. On the outward journey, his aircraft was intercepted by two enemy fighters whose pilots attacked simultaneously; one from dead ahead and the other from the rear. In the ensuing combat, Flt. Sgt. Elliott, by skilful tactics, enabled his gunners to destroy one of the attackers and drive off the other. Although his aircraft sustained some damage, he resolutely flew on, reached his target and bombed it. In this, his first operational sortie, Flt. Sgt. Elliott displayed courage and determination of a high order.

Flt. Sgt. J. METCALF, No. 408 Sqn.—This airman was the pilot of an aircraft detailed for an sortie in the El Darba area one night in July, 1942. On the return journey, after his objective had been bombed successfully, his aircraft was intercepted by a Ju.88. The enemy's opening fire inflicted some damage and, whilst Flt. Sgt. Metcalf was taking avoiding action his aircraft was again hit; this time in the fuselage, port wing and the rear turret. Both aircraft had lost some height and, to avoid further attacks, Flt. Sgt. Metcalf decided to make a violent dive. In the early stages of the dive, the rudder control was damaged by the enemy's fire and rendered almost immovable, but Flt. Sgt. Metcalf succeeded in pulling the aircraft out of its dive at a low altitude. Immediately two vivid yellow flashes were observed below him, and it is believed that they were caused by the attacking aircraft striking the ground. Handing over the controls to his second pilot, Flt. Sgt. Metcalf then rendered first-aid to his wounded wireless operator. Eventually, the aircraft was flown to a base and a skilful landing was effected. In the face of harassing circumstances, this airman displayed high courage and skill.

Sgt. E. K. F. BRASHER, R.A.A.F., No. 460 (R.A.A.F.) Sqn.—One night in August, 1942, this airman captained an aircraft which attacked Dusseldorf. On the outward flight, when some 40 miles from the target, his aircraft was attacked by a hostile aircraft and sustained damage to the tailplane. Despite this, St. Brasher pressed on and bombed his objective. Shortly after leaving the target area, his aircraft was attacked by a Ju.88. Further damage was sustained and the wireless operator was wounded. Sgt. Brasher, skilfully manœuvring his aircraft, enabled his rear gunner to fire an effective burst at the attacker, which caused it to break away enveloped in flames. Sgt. Brasher flew his damaged aircraft safely to base. Throughout, he displayed great courage and determination to complete his mission.

Gen. Sikorski, Polish Commander-in-Chief, accompanied by Mr. Hugh Dalton, held an investiture on the occasion of a Polish Squadron's birthday. He is seen shaking hands with a Polish sergeant after presenting the medals.

Roll of Honour

Casualty Communique No. 154.

THE Air Ministry regrets to announce the following casualties on various dates. The next of kin have been informed. Casualties "in action" are due to flying operations against the enemy; "on active service" includes ground casualties due to enemy action, non-operational flying casualties, fatal accidents and natural deaths.

Royal Air Force

KILLED IN ACTION.—Sgt. E. Bailey, Sgt. W. G. Pissenden, Sgt. A. Mannering, Sgt. C. H. May, W/O F. N. Morse, Sgt. T. B. Phillips, W/O. J. Sands, Flt. Sgt. P. C. Terry, Sgt. W. C. Wilson.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Sgt. P. I. Ferebee; Flt. Sgt. E. F. Porter.

DIED OF WOUNDS OR INJURIES RECEIVED IN ACTION.—Sgt. E. C. Summerfield.

MISSING, BELIEVED KILLED IN ACTION.—Flt. Sgt. A. W. Doughty, Sgt. R. L. Hill; Sgt. J. W. Neu; Flt. Sgt. T. G. Wood.

MISSING.—Act. Sqn. Ldr. N. Anderson; Sgt. K. I. Austin; Grp. Capt. P. R. Barwell, D.F.C.; P/O. R. G. Bennett; Sgt. L. H. Bradbrook; Sgt. E. R. J. Burrell; Sgt. L. E. Clarke; Sgt. H. Cooke; Spt. J. C. Cubitt; Sgt. D. J. Curling; Sgt. S. H. Cusden; Sgt. H. Dauncey; Sgt. H. Dronfield; P/O. D. Ellis; Sgt. R. Fairhurst; Sgt. J. E. T. Foot; P/O. P. G. Frith; Sgt. G. B. Gane; Flt. Sgt. P. W. Gregory; Sgt. J. Grocock; Flt. Sgt. R. J. Goode; Sgt. A. Hartley; Flt. Sgt. R. J. Horlock; Sgt. R. O. L. Humphrey; Sgt. G. A. Hunt; Sgt. P. F. Inman; Sgt. G. G. Jeary; Wing Cdr. K. D. Knocker; Sgt. J. G. Laurence; Flt. Lt. H. Liversidge; Sgt. A. McLeod; Sgt. J. Mainwaring; Sgt. F. W. Mutton; Sgt. A. Nightingale; Sgt. T. E. L. Palmer; Sgt. D. I. Parry; Sgt. R. W. Payze; P/O. D. T. W. Phillips; Flt. Sgt. R. E. Pithers; Sgt R. T. Plant; Flt. Sgt. W. G. Potter; Sgt. J. Pritchard; Sgt. V. H. Rainbow Sgt. J. M. Raine; Sgt. A. P. Read; Sqn. Ldr. I. G. Richmond, D.F.C.; Sgt. R. H. Ritchie; Flt. Sgt. F. Roe; Sgt. S. B. Rowland; Act. Flt. Lt. T. E. Salazer, D.F.C.; Sgt. J. Samson; P/O. F. E. Scott; P/O. R. E. S. Summers; F/O. E. H. Tomlinson; Sgt. H. V. Turton; Sgt. J. W. C. Underwood; Sgt. H. H. W. Vinter; Sgt. K. G. Walker; Sgt. W. McD. Watson; Sgt. S. J. Webster; Sgt. W. Weightman; P/O. J. A. Whittingham; Sgt. K. D. Wright.

KILLED ON ACTIVE SERVICE.—Sgt. J. E. Ashwell; Sgt. W. A. G. Atkins; A/C.1 H. Baynham; Sgt. D. Bradshaw; Sqn. Ldr. C. L. F. Colmore; Wing Cdr. J. A. Dixon; Sgt. E. Dolphin; L.A/C. J. Drainer; P/O. H. E. J. Giles; Sgt. R. P. Gillott; Sgt. A. Guthrie; Sgt. J. S. da S. Haley; Act. Sgt. W. Hill; P/O. M. G. Lees; Sgt. T. McCormick; Sgt. D. J. Mackenzie; Act. Sgt. W. P. Marshall; P/O. B. C. Middleton; Sgt. H. U. Morrison; Sgt. A. R. Parker; Sgt. P. C. H. Phillips; P/O. K. Radford; Sgt. T. R. Robieson; Sgt. A. C. Sallis; Sgt. A. J. Smith; Sgt. R. H. Smith; Sgt. G. E. Step; Sgt. H. H. Whitmee; Sgt J. E. Williams.

WOUNDED OR INJURED ON ACTIVE SERVICE.—A/C.2 A. G. Burgess; A/C.1 L. F. Catchpole; Sgt. W. A. Chisholm; Sgt K. H. Jefferson; Act. Sgt. G. W. Jones; P/O. W. G. Maclennan; P/O. A. S. Pearson; Sgt. I. V. Peters; Sgt. F. G. Reynolds; L.A/C. W. H. Rogers; P/O. B. F. Simonds; Sgt. W. G. Snelling; P/O. W. A. W. Strachan.

DIED OF WOUNDS OR INJURIES RECEIVED ON ACTIVE SERVICE.—L.A/C. E. W. F. Charrosin; F/O. S. H. Miller; P/O. R. N. Walford.

DIED ON ACTIVE SERVICE.—A/C.2 W. J. Amor; Sgt. J. D. Bates; A/C.1 W. H. Brown; L.A/C. E. Byers; A/C.1 W. J. Candler; L.A/C. E. E. Caswell; Cpl. V. S. Chenery; L.A/C W. J. Chilvers; A/C.1 S. H. Clark; A/C.2 A. H. Coleman; L.A/C. J. C. Corby; Sgt. H. K. Mackay; L.A/C. J. E. Green; A/C.1 H. Holding; Sgt. A. W. C. Jerman; A/C.2 W. J. Newman; Cpl. S. Page; Act. Flt. Lt. R. K. Porter; A/C.2 R. J. Reid; Cpl. H. G. Richardson; P/O. E. J. A. Roberts; Cyl. F. G. Smith; Sgt. L. Smithwhite; Cpl. C. West; L.A/C. A. E. White; Cpl. A. Winter; L.A/C. R. H. Wong; L.A/C. G. J. Wright.

Women's Auxiliary Air Force

DIED ON ACTIVE SERVICE.—A/CW.1 C. M. A. Archer.

Royal Australian Air Force

KILLED IN ACTION.—Sgt. L. Broomfield; Sgt. J. W. Clarke; Sgt. J. F. Crozier; Sgt. C. P. Lawton; P/O. C. T. O'Brien.

WOUNDED OR INJURED IN ACTION.—Sgt. K. C. Applekamp; Sgt. A. C. Maclure; Sgt. H. P. Pearson.

MISSING, BELIEVED KILLED IN ACTION.—Sgt. J. H. Moss.

MISSING.—Sgt. M. Caddy; Sgt. N. H. Cox; Sgt. T. S. Caffney; Sgt. N. M. Hardy; Sgt. R. L. Hugall; Sgt. E. G. Johnson; Sgt. J. W. Lindsay; Sgt. J. B. Mathers; Sgt. J. S. Peters; Sgt. K. H. Poynting; Sgt. J. M. Synnott; Sgt. L. C. Thompson.

KILLED ON ACTIVE SERVICE.—P/O. B. K. Armstrong; Sgt. A. L. Gane.

DIED OF WOUNDS OR INJURIES RECEIVED ON ACTIVE SERVICE.—P/O. J. M. Bonneman.

Royal Canadian Air Force

KILLED IN ACTION.—Sgt W. W. Burns; P/O. F. B. Morgan; P/O. R. E. Wigle.

WOUNDED OR INJURED IN ACTION.—Flt. Sgt. C. S. G. De Mancrede; P/O. B. Smith.

MISSING BELIEVED KILLED IN ACTION.—Flt. Sgt. W. Linwood; Flt. Sgt. E. D. Moye; Sgt. A. P. Quellette.

MISSING.—Sgt. W. E. Alcazar; Sgt. R. J. Anderson; Sgt. L. A. M. Cauchy; Flt. Sgt J. E. Cole; Flt. Sgt. D. Cranswick; Sgt. B. A. Dakin; Sgt. L. N. Dearlove; Flt. Sgt. F. F. Duff; Flt. Sgt. A. K. Farnie; Flt. Sgt. M. A. Fawcett; Flt. Sgt. I. W. Griffin; Sgt. T. Gibbons; F/O. G. G. O. James; Sgt. J. H. Kinch; P/O. H. M. Lacelle; P/O. T. F. Lamb; Sgt. A. G. McFee; Flt. Sgt. H. E. Magladry; P/O. D. Malofie; Sgt. B. Morgan; Flt. Sgt. R. F. Noton; Sgt. N. M. Oulster; Sgt. D. Pearce; Sgt. G. A. Pearce; Flt. Sgt. G. McL. Phillips; Flt. Sgt. W. J. Ruddy; W/O. W. L. Scott; Sgt. A. M. Spear; Sgt G. B. Tatham; Sgt. V. R. Whelpley; Sgt. E. G. Wilson.

KILLED ON ACTIVE SERVICE.—P/O. J. A. Epp; P/O. C. W. Gomm; Sgt. J. R. Griffin; Sgt. T. E. Helgesen; Sgt. F. B. G. Heron; Sgt. J. F. Hirst; P/O. G. F. J. Hoben; P/O. D. A. McMaster; Sgt. G. D. Maluish; L.A-C. G. S. Miller; Sgt G. E. Pickel; Sgt L. J. Reginbal; LA/C. D. Vail.

WOUNDED OR INJURED ON ACTIVE SERVICE.—P/O. T. J. Gorman; P/O. D. S. Todd.

DIED OF WOUNDS OR INJURIES RECEIVED ON ACTIVE SERVICE.—P/O. R. N. Bailey; Sgt. J. A. Parkinson; Sgt. H. J. Ralston.

Air Chief Marshal Sir Sholto Douglas, Crown Prince Olav and Crown Princess Martha of Norway photographed on the occasion of the presentation by King Haakon of the Norwegian War Cross to Squadron Leaders Mehre, Mohr and Birksted. All three of these officers fly with the Norwegian squadrons under Fighter Command.

Royal New Zealand Air Force

KILLED IN ACTION.—Sgt. F. O. H. Harrison; Sgt. R. J. Smart; P/O. R. F. Watson.

MISSING.—Sgt. B. W. Bailey; Sgt. W. H. Flower; Sgt. J. G. G. Hegan; Sgt. M. G. McGregor; P/O. W. J. Monk; Sgt. E. F. S. Moncrief; Sgt. R. J. Parish; Sgt. D. H. Randle; Sgt. J. C. Roy; Sgt. G. Wilson; Sgt. S. L. Wilton.

KILLED ON ACTIVE SERVICE.—Sgt. J. H. Smith.

South African Air Force

WOUNDED OR INJURED IN ACTION.—Major G. L. Le Mesurier; 2/Lt. J. V. Lindbergh.

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Royal Air Force

It is regretted that Act. Wing Cdr. V. S. Butler, D.F.C., was incorrectly described as Sqn. Ldr. in the Royal Air Force Casualty Communiqué published in our issue of September 10, 1942.

KILLED IN ACTION.—Sgt. M. W. Apperson; Sgt. J. W. R. Atkinson; Sgt. J. W. Calvert; Sgt. W. Colloton; Sgt. A. E. Dignum; Sgt. J. C. Hazelgrove; Sgt. E. S. Hunt; Sgt. A. J. M. Leete; P/O. T. V. Maunders; Sgt. L. F. Perry; Sgt. I. Reid; Sgt. J. D. W. Sykes; Sgt. A. J. Western; Sgt. R. W. Wilson.

WOUNDED OR INJURED IN ACTION.—Flt. Lt. W. T. Aitken; Sgt. J. T. Boddington; Sgt. F. E. D. Careless; Flt. Sgt. P. Comrie; Sgt. J. G. Cosby; P/O. H. C. Drake; P/O. S. J. French; Sgt. W. B. Goode; P/O. E. S. Hayes; Flt. Lt. P. S. A. Hillier; Sgt. D. Macpherson; Sgt. J. Moffat; Sgt. A. J. Newton; Sgt. J. H. Ridd; Sgt. J. F. H. Steer; P/O. E. J. Townsend; P/O. R. D. Wall.

DIED OF WOUNDS OR INJURIES RECEIVED IN ACTION.—Sgt. G. Clingings.

MISSING.—Flt. Sgt. W. Adamson, D.F.M.; Act. Sqn. Ldr. G. W. Alexander; W/O. W. R. Allison; Act. Flt. Lt. W. G. Barnes, D.F.C.; Sgt. R. E. Barr; Sgt. R. A. Chapman; Sgt. C. G. Cockayne; Sgt. R. I. Coffin; Wing Cdr. H. D. Cooke; Act. Sqn. Ldr. C. N. Crook; Flt. Sgt. F. Cross; P/O. C. W. Dellow; P/O. D. C. Evans; Sgt. G. Ewen; Sgt. R. Farmer; Act. Sqn. Ldr. J. H. Franks, D.F.C.; Sgt. R. Gallagher; Sgt. P. E. Gartell; Sgt. T. G. Gunn; Sgt. A. J. Hamlyn; Sgt. P. F. Hickley; Flt. Sgt. R. Holden; Flt. Sgt. F. C. House; Flt. Sgt. R. A. W. Hubbard; Sgt. T. H. Inch; Sgt. J. R. Jones; Sgt. T. W. Joy; Sgt. R. H. Kelly; Sgt. J. McK. Kennedy; Sgt. A. G. Leyland; Sgt. R. J. Livetsuch; Sgt. L. S. Lloyd; Flt. Sgt. G. McGlynn; F/O. J. E. Makgill; Sgt. C. T. R. Matthewman; Sgt. T. P. Morgan; Sgt. S. A. Morrison; Sgt. G. M. Murphy; P/O. P. E. O'Meara; Sgt. A. O'Quinn; Flt. Sgt. C. P. Philp; Sgt. N. F. Poulton; Sgt. L. N. Reynolds; P/O. B. A. C. Richards; Sgt. J. Rooney; Sgt. W. C. Scarlett; Sgt. L. Shearer; W/O. J. G. Simpkin; Sgt. F. Squires; Sgt. R. T. Sudbury; Sgt. G. J. Summners; Sgt. J. Swales; Sgt. M. Sweeney; Sgt. W. E. Thomas; P/O. R. Van Toen; Sgt. G. A. White; Flt. Sgt. L. Wiltshire; Sgt. N. Windle.

MISSING, BELIEVED KILLED ON ACTIVE SERVICE.—L.A/C. T. Reid.

KILLED ON ACTIVE SERVICE.—P/O. F. D. Alston; Flt. Sgt. J. C. Atkinson; A/C.2 D. E. B. Attwool; Sgt. R. W. W. Basham; Sgt. H. A. Baxter; A/C.1 C. P. Bird; P/O. F. Biver;

The *Ile de France* squadron of the Fighting French receiving the *Croix de Guerre* at "Guynemer Day" celebrations.

SERVICE AVIATION

Flt. Sgt. H. Briggs; P/O. P. P. Clarke; Sgt. M. Cooke; P/O. J. W. Craig; F/O. T. F. J. Crudden; P/O. F. S. Day; Sgt. R. V. De Pedesta; Sgt. P. A. Dorman; Sgt. A. Dunn; P/O. H. H. Elliot; Act. Grp. Capt. C. A. H. Evans; Sgt. K. A. R. Evans; Flt. Lt. A. F. P. Fane; F/O. A. H. E. Frost; Flt. Lt. P. Gearey; P/O. S. E. Godwin; P/O. K. Halstead; Sgt. R. A. Hawkins; F/O. A. K. C. Holder; L.A/C. D. P. Hollands; L.A/C. R. W. Holmes; L.A/C. B. W. Howcroft; L.A/C. W. G. Lamont; L.A/C. P. W. Longbottom; P/O. E. A. Main; L.A/C. E. W. Martin; Sgt. L. H. Matthews; Flt. Sgt. S. J. Miles; Sgt. E. Moores; Sgt. C. Moyer; Sgt. S. J. Parsons; L.A/C. R. B. Pinsent; Sgt. E. Place; L.A/C. S. A. Platt; Sgt. R. F. Shirley; Act. Sgt. W. B. Spencer; Sgt. W. Stephen; L.A/C. K. F. Stevens; Sgt. C. R. Taylor; Sgt. J. O. Twelvetrees; Flt. Sgt. B. Walmsley; Sgt. J. C. Williams; P/O. J. F. Withy.

WOUNDED OR INJURED ON ACTIVE SERVICE.—Cpl. J. R. Aitken; A/C.1 C. Bates; Sgt. G. H. Cox; L.A/C. E. G. C. Crowther; Cpl. A. MacD. Davie; L.A/C. H. E. Naylor.

DIED OF WOUNDS OR INJURIES RECEIVED ON ACTIVE SERVICE.—L.A/C. S. G. Logan; P/O. F. O'Donnell; P/O. D. A. Pascoe.

DIED ON ACTIVE SERVICE.—A/C.1 F. H. Avern; L.A/C. W. G. Banks; Cpl. D. Bates; Act. Sqn. Ldr. S. H. Cave; Sgt. J. S. Cheeseborough; Act. Flt. Lt. E. R. Childe-Freeman; L.A/C. R. G. Collinson; L.A/C. Z. C. Draper; Flt. Sgt. S. A. Fawcett; A/C.2 A. Gordon; Flt. Sgt. B. J. Hargreaves; Flt. Sgt. R. T. Hobby; L.A/C. K. Howard; L.A/C. F. Jackson; L.A/C. B. C. Oliver; Act. F/O. G. M. Osborne; A/C.1 A. E. Townsend; L.A/C. J. W. Usherwood.

Royal Australian Air Force

KILLED IN ACTION.—Sgt. J. V. Cruikshank; Sgt. R. J. Laing; Sgt. H. E. Lake; Flt. Sgt. F. G. Livingston.

MISSING.—Sgt. I. F. McManus; P/O. P. R. V. Sullivan; Sgt. E. D. Williams.

KILLED ON ACTIVE SERVICE.—Sgt. K. J. Bradley; Sgt. W. H. Condon; Sgt. L. D. Craven; Sgt. F. L. Ellers; Sgt. E. D. R. Jenning; Sgt. K. H. C. Steinbach; P/O. J. Trenberth; Sgt. G. E. Warburton; Sgt. R. D. Wells.

WOUNDED OR INJURED ON ACTIVE SERVICE.—Sgt. J. H. Levett.

Royal Canadian Air Force

KILLED IN ACTION.—Flt. Sgt. R. B. Albright; Sgt. Q. Diperslo; Flt. Sgt. R. W. Hexter; P/O. E. W. Ollen-Bittle; Sgt. J. E. Otis; Sgt. T. R. Owens; Flt. Sgt. J. P. Richardson; P/O. G. F. Strong; Flt. Sgt. W. C. Thurlow.

WOUNDED OR INJURED IN ACTION.—W/O. R. J. S. Dawson; P/O. W. Q. Dewar; Sgt. J. C. Hughes; P/O. C. S. McLean.

MISSING.—Sgt. E. K. Brennan; Sgt. J. K. Crossing; Sgt. W. H. Gardner; Flt. Sgt. R. A. A. Gorien; Sgt. J. C. Hadley; P/O. R. J. Jackson; Sgt. D. F. Lord; Sgt. D. A. Millard; Flt. Sgt. B. A. Miller; Sgt. R. M. Urquhart; Flt. Sgt. L. Sidney; P/O. C. W. Simmons; Flt. Sgt. D. L. Torkelson; Sgt. C. S. Walsh; P/O. J. C. Watson; F/O. K. White; Sgt. G. L. Wilkinson; Sgt. A. Yankoski.

KILLED ON ACTIVE SERVICE.—Sgt. C. Auld; Sgt. C. S. Barber; Sgt. A. M. Begg; Flt. Sgt. R. F. Casey; Sgt. J. G. Fruchtl; P/O. P. W. M. Harley; Sgt. A. C. Gibson; Sgt. C. P. Ralph; Act. W/O. H. W. Williamson.

WOUNDED OR INJURED ON ACTIVE SERVICE.—Sgt. L. A. Caddell.

Royal New Zealand Air Force

KILLED IN ACTION.—Sgt. P. R. Kingsford.

WOUNDED OR INJURED IN ACTION.—Sgt. W. P. Hermansen.

MISSING.—Sgt. V. A. B. Falk; Sgt. L. A. Mitchell; Sgt. H. A. T. Watson.

KILLED ON ACTIVE SERVICE.—Sgt. M. V. Cato; P/O. I. H. Irvine, D.F.M.; Sgt. H. P. Johnson; Sgt. J. N. Nicol; Sgt. L. E. Pole.

South African Air Force

KILLED IN ACTION.—Lt. H. J. Beyley; Lt. O. W. D. Grey; Air Sgt. A. C. Essfrey; Lt. L. A. Nichol.

WOUNDED OR INJURED IN ACTION.—Major S. A. Pharoah; Lt. H. C. Warren.

MISSING.—Flt. Sgt. J. A. Colverd; Lt. A. M. Donnelly; Sgt. J. A. Hill; Lt. E. Jones.

KILLED ON ACTIVE SERVICE.—Lt. R. S. Carr; 2/Lt. F. S. Luyt; Lt. C. C. G. Peak.

Indian Air Force

DIED ON ACTIVE SERVICE.—Sepoy Abdul Ghani.

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Royal Air Force

KILLED IN ACTION.—Flt. Sgt. C. S. Anderson; Flt. Sgt. D. Flockhart; Sgt. F. Hebron; Sgt. D. J. Newcomia; Sgt. D. K. Peart; Flt. Lt. N. E. Sharp; Flt. Sgt. R. L. Somerville.

The Carter Bomber trainer used by a Wood Green squadron of the A.T.C. Mr. George Dowty, of Dowty Equipment Ltd., collaborated with Mr. Carter in the design. The engine and hydraulic pipe lines can be seen on the right.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Flt. Sgt. R. Exelby; Flt. Lt. G. G. Heathcote; Flt. Sgt. E. H. Keeping; Flt. Sgt. J. Peters; P/O. C. L. Smith, D.F.M.

WOUNDED OR INJURED IN ACTION.—F/O. C. M. Hone; Sgt. D. G. Tupper; L.A/C. J. Parker; P/O. D. H. Wales.

DIED OF WOUNDS OR INJURIES RECEIVED IN ACTION.—Sgt. A. Macaskill; Flt. Sgt. W. C. Stanbury.

MISSING, BELIEVED KILLED IN ACTION.—P/O. O. W. H. Berkeley-Hill; F/O. J. C. Buckley; Sgt. G. J. Craggs; Flt. Sgt. D. Diamond; P/O. A. G. E. Harding; Flt. Sgt. J. S. A. Hodge; P/O. J. Hurst; W/O. W. S. Miller; Sgt. E. P. Presland; P/O. W. T. Smith; Flt. Sgt. D. H. Taylor.

MISSING.—Sgt. R. F. Ansell; Sgt. J. Armstrong; Sgt. K. Arnott; Sgt. R. A. Attwater; Sgt. B. J. Austin; Sgt. W. T. Balchin; Sgt. D. R. Barrett; Flt. Sgt. K. G. Baugh; Sgt. R. N. Baxter; Sgt. A. D. Bond; Sgt. A. A. Brace; Sgt. J. Brown; Sgt. S. R. Burford; Sgt. J. V. Carlile; Flt. Sgt. F. Chapman; Sgt. F. V. Clayton; Flt. Sgt. D. C. H. Copping; Sgt. H. C. Craig; Sgt. A. Danby; Act Sqn Ldr. L. H. Day, D.F.C.; P/O. A. A. Delve; Sgt. F. Dick; Sgt. W. D. Drew; Sgt. W. E. Dwyer; P/O. T. E. Errington; P/O. J. N. Eslick; Sgt. A. C. Ezra; Sgt. J. Forsyth; Sgt. N. Fountain; Sgt. H. A. George; Sgt. H. J. Gill; Sgt. W. Gordon; Sgt. J. A. P. Goss; Sgt. G. A. Gow; Flt. Sgt. R. H. Groom; Sgt. P. T. Halstead; Sgt. J. K. L. Heath; P/O. C. M. Henning; Sgt. W. W. Hughes; P/O. D. W. Ilott; Sgt. M. Jones; Sgt. H. E. Kemball; Sgt. E. Knight; P/O. R. W. Komiski; Flt. Lt. E. C. Lane-Sansam, D.F.C.; Sgt. W. H. Leedham; Sgt. W. F. Lefevre; Sgt. H. J. I. Lockhart; Sgt. E. C. Marshall; Flt. Sgt. J. J. Martin; Sgt. R. T. C. Martin; Flt. Lt. C. W. Miller; Sgt. G. S. Mills; Sgt H. J. Morgan; Sgt. F. W. Morrell; Sgt. J. W. Morton; Sgt. R. Nicholls; P/O. H. C. Nichol-Smith; Sgt. R. Parker; Sgt. A. J. Payne Act. Sqn. Ldr. V. A. Pedersen; Sgt. L. P. Plum; Sgt. P. F. Porter; Sgt. A. L. Potts; Sgt. W. E. Pring; P/O. F. A. Scott; Sgt. E. J. Simmons; P/O. H. M. Simon; Sgt. E. O. Smith; Sgt. R. T. Smith; Sgt. C. H. Stewart; Sgt. K. C. Swaby; Sgt. L. J. Symonds; Sgt. J. B. Teasdale; P/O. J. R. Tregea; Sgt. B. H. Vickery; Sgt. P. J. Voyzey; Sgt. L. Warwick; Sgt. R. Waters; Sgt. L. G. Watling; Sgt. J. E. F. Waylan; Act. Sqn. Ldr. P. W. M. West, D.F.C.; Sgt. O. L. Williams; Sgt. H. T. Willig; Sgt. N. R. Wiltcher.

MISSING, BELIEVED KILLED ON ACTIVE SERVICE.—L.A/C. R. B. Thorp; Sgt. D. H. Yeo; Sgt. N. H. Zamek.

KILLED ON ACTIVE SERVICE.—Flt. Lt. B. S. Bannister, D.F.C.; Sgt. C. R. Bell; P/O. R. J. Bennett; Sgt. A. M. Blyth; L.A/C. J. B. M. Bryson; Sgt F. H. S. Bush; Flt. Sgt. T. D. Butcher; Sgt. D. E. Carpenter; Sgt. G. B. Crawford; Sgt. M. Davies; Sgt. T. D'Hondt; Sgt. K. C. Ellis; Sgt. L. E. Fairchild; L.A/C. H. R. Forster; Sgt. A. H. S. Henderson; Sgn. Ldr. A. W. Hoggar; Sgt. G. C. Jardine; P/O. C. R. Jarred; P/O. D. W. Kent; P/O. P. H. Lowther; Sgt. R. J. McKean; F/O. A. C. R. McLure; Wing Cdr. M. M. MacMullan; Sgt. R. M. Mathieson; P/O. G. C. Miall; L.A/C. T. Moseley; Sgt. N. Moss; P/O. D. Page; Sgt. W. E. S. Rayner; Sgt. J. Reeves; P/O. J. B. G. Rogers; P/O. J. P. Sadd; A/C.1 G. E. Smith; Sgt. J. Teevin; A/C.1 K. M. Tucker; Sgt. M. Wayne; P/O. K. T. White.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED ON ACTIVE SERVICE.—L.A/C. J. Oldfield.

WOUNDED OR INJURED ON ACTIVE SERVICE.—A/C A. Azzopardi; A/C.1 R. J. Burke; A/C.2 W. Charlesworth; A/C.2 A. Dempsey; A/C.1 T. Dykes; A/C.2 K. Lockwood; A/C.1 R. O'Neill; A/C.1 R. Rhodes.

DIED OF WOUNDS OR INJURIES RECEIVED ON ACTIVE SERVICE.—Wing Cdr. C. D. B. Wallis, D.S.O.

DIED ON ACTIVE SERVICE.—A/C.1 R. D. Bailey; A/C.2 L. H. Dunford; L.A/C. G. A. Gray; A/C.1 W. Grinrod; Flt. Sgt. R. S. Hanson; A/C.2 N. B. Heygate; Flt. Sgt. H. Lea; A/C.2 A. C. C. Lloyd; A/C.1 I. T. Moody; L.A/C. J. Ramsey; A/C.2 A. Rhodes; Sgt. G. P. Rudston; A/C.2 J. P. H. Sargeant; L.A/C. J. Self; A/C.1 H. L. Tall; P/O. T. E. Tulip; Cpl. W. W. Wilshire.

Women's Auxiliary Air Force

DIED ON ACTIVE SERVICE.—A/C.W.2 M. G. Todd.

Royal Australian Air Force

KILLED IN ACTION.—Sgt. H. E. W. Godfrey; Sgt. M. Solomon; Sgt. E. L. Waldron.

MISSING, BELIEVED KILLED IN ACTION.—Sgt. H. E. Birk; P/O. H. Leisk; P/O. G. Mallaby; P/O. J. C. Pottie.

MISSING.—Sgt. T. D. Belford; Sgt. F. O. Brayne; Sgt L. C. U. Dreyer; P/O. A. B. Gurry; Sgt. I. MacD. King; Sgt. M. R. Kleisdorff; Sgt. T. B. Langoulant; Sgt. E. J. Lawer; Flt. Sgt. R. L. Melville; Sgt. A. L. Moyle; Sgt. R. J. Perry; Sgt. R. J. B. Sharkey; Sgt. N. L. Smith; Sgt. R. A. Willis.

KILLED ON ACTIVE SERVICE.—P/O. N. P. P. Kearney; Sgt. J. K. Marsaman; Sgt. W. E. Mason; Sgt R E. Moie.

Royal Canadian Air Force

KILLED IN ACTION.—Flt. Sgt. W. L. Belous.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Sgt. W. R. O'Neill.

MISSING, BELIEVED KILLED IN ACTION.—F/O. L. O'G. Warner.

MISSING.—Flt. Sgt. J. D. Ailey; Sgt. T. E. Crowthers; Sgt. G. Dogue; Flt. Sgt. W. E. N. Field; Flt. Sgt P. C. Fitzgerald; Sgt. J. E. Gibbs; Sgt. S. Gregory;; Sgt. G. M. Killeen; Flt. Sgt. A. E. Nickerson; Sgt. T. C. Parry; W/O. G. Scott; P/O. R. L. Storey; Sgt. H. F. Thompson; P/O. J. C. Weir; Flt. Sgt. R. J. Westgate; Sgt. C. G. Wilde.

KILLED ON ACTIVE SERVICE.—P/O. W. B. Carlyle; Sgt. A. G. Gibson; P/O. G. R. Hanna; Flt. Lt. W. D. W. Hilton; Sgt. R. G. E. Kater; Sgt. J. E Lemon; Act. Flt. Lt. J. F. McGrath; Sgt. J. E. S. Walker.

Royal New Zealand Air Force

KILLED IN ACTION.—P/O. H. C. S. Cotton, D.F.M.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Sgt. C. P Goulding.

MISSING, BELIEVED KILLED IN ACTION.—Sgt. M. C Fell; P/O. T. H. Smith.

MISSING.—Sgt. M. L. Berg; P/O. A. S. Broun; P/O. G. L. Donne; F/O. J. R. Gaveaan; Sgt. S. H. Gunn; Sgt. F. E. McKenzie; P/O. D. N. Potts; Sgt. G. A. Young.

MISSING, BELIEVED KILLED ON ACTIVE SERVICE.—Sgt. J. Treister.

KILLED ON ACTIVE SERVICE.—P/O. C. W. B. Barton.

South African Air Force

KILLED IN ACTION.—Lt. B. Mackenzie.

MISSING.—Maj. J. L. Hewitson; Lt. J. W. R Somerville; 2/Lt. W. G. D. Wilson.